सत्यमेव जयते

THE

INDIAN ASTRONOMICAL EPHEMERIS

FOR THE YEAR

2020

POSITIONAL ASTRONOMY CENTRE
INDIA METEOROLOGICAL DEPARTMENT
MINISTRY OF EARTH SCIENCES

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Issued under the authority of

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PREFACE

The Indian Astronomical Ephemeris is published annually by the India Meteorological Department (IMD) for providing data to astronomers. The speciality of this publication is that it contains calendric information which caters to the requirement of the country's panchang makers and other users. Thus it has great civil and cultural significance. This has been the mandate given to the Positional Astronomy Centre at Kolkata by the Govt. of India.

The calculations of the Indian Calendar portion, such as tithi, nakshatra etc. are given in Indian Standard Time (IST) and covers an extended period upto 21st March 2021 which is the end of the year 1942 Saka Era of the Indian National Calendar. A separate note has also been given to explain the terminology and the basis of different calculations relating to the Indian Calendar.

The epoch of the standard reference system in this publication is J 2000.0 and the argument of the ephemerides is Terrestrial Time (TT). Resolutions of the International Astronomical Union (IAU) recommending the changes from time to time including a list of new IAU constants are given in Part VI - Indian Calendar and Explanation.

Our sincere thanks are due to the Nautical Almanac Office, United States Naval Observatory and Her Majesty's Nautical Almanac Office, U.K.

The work of preparation and publication of the Indian Astronomical Ephemeris for 2020 has been done under the supervision of Shri S. Sen, Director, Positional Astronomy Centre, India Meteorological Department, Kolkata.

Dr. K. J. Ramesh
Director General of Meteorology

Mausam Bhawan
New Delhi - 110 003
29th July, 2019 A.D.
(7 Sravana, 1941 Saka Era)

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PART - I

TIME, SUN, MOON, PLANETS

TIME-SCALE, 2020

Julian date for Standard epoch

1900 January 0, 12^h U.T.						=	JD	241	5020.0
B	1950.0	=	1950	Jan.	0.923	=	JD	243	3282.423
B	2020.0	=	2020	Jan.	0.877	=	JD	245	8849.377
J	2020.5	=	2020	July	2.125	=	JD	245	9032.625
J	2000.0	=	2000	Jan.	1.5	=	JD	245	1545.0

Tabulations of Julian date against calendar date for 2020 are given on pages 4 to12 and for other years are given at Table IX of Part-V on page 359.

The fraction of the year from 2020.5 is tabulated with the Besselian day numbers on pages 244-251.

The lengths of the principal years and mean months at 2020.0 as derived from the Sun's mean motion and mean Orbital elements respectively are:

Length of the year (ephemeris days) :

	d		d	h	m	s
Tropical (equinox to equinox)	365.242190	=	365	05	48	45.2
Sidereal (fixed star to fixed star)	365.256363	=	365	06	09	09.8
Anomalistic (perigee to perigee)	365. 259635	=	365	06	13	52.5
Eclipse (node to node)	346. 620074	=	346	14	52	54.4

Length of the Month (ephemeris days)

	d		d	h	m	s
Synodic (new moon to new moon)	29.5305888	=	29	12	44	02.9
Tropical (equinox to equinox)	27.3215822	=	27	07	43	04.7
Sidereal (fixed star to fixed star)	27.3216615	=	27	07	43	11.6
Anomalistic (perigee to perigee)	27.5545501	=	27	13	18	33.1
Nodical (node to node)	27.2122207	=	27	05	05	35.9

		h	m	s
Length of the day:	Mean Sidereal	23	56	04.09053 of mean Solar time.
	Mean Solar	24	03	56.55537 of mean Sidereal time.

CHRONOLOGICAL TABLE

CHRONOLOGICAL CYCLES

Golden Number or Lunar Cycle	VII	Solar Cycle	13
Epact	5	Roman Indiction	13
Dominical Letter	ED		

CHRONOLOGICAL ERAS

The year 1942 of the Saka Era (Indian National Calendar) begins on March 21, 2020.
The year 1942 of the Saka Era or Saka Shalivahana (Lunisolar, Traditional Calendar) begins on March 25, 2020.
The year 1942 of the Saka Era (Solar, Traditional Calendar) begins on April 14, 2020.
The year 5121 of the Kali Era begins on April 14, 2020.
The year 2077 of the Vikram Samvat begins on March 25, 2020 (Chaitradi) and November 16, 2020 (Kartikadi) according to different systems of reckoning.
The year 1427 of the Bengali San begins on April 14, 2020.
The year 1196 of the Kollam Era begins on August 17, 2020.
Jovian year (Barhaspatya Varsa or 60-year cycle of Jupiter) 48 Ananda begins on June 1, 2020 (North Indian Usage), and 34 Sarvari on March 25, 2020 (Lunar Chaitradi) or April 14, 2020 (Solar) (South Indian Usage).
Vedanga Jyotisa year 1- Samvatsara of the 5-year cycle (389 th cycle of Paitamaha Siddhanta) begins on January 25, 2020.
The year 2564 of the Buddha Nirvana era begins on May 7, 2020.
The year 2547 of the Mahavira Nirvana Era begins on November 16, 2020.
The year 1442 of the Mohammedan Era begins on August 21, 2020.
The year 1390 of the Yazdejardi Era begins on August 16, 2020 according to the Indian Parsi (Shahenshahi) Calendar.
The year 6733 of the Julian period begins on January 14, 2020.
The year 5781 of the Jewish Era (A.M.) begins on September 19, 2020.
The year 2796 of the Greek Olympiad, being the 4th year of the 4-Year cycle (699 th Olympiad) begins on July, 2020.
The year 2773 of the Foundation of Rome (A.U.C.) begins on January 14, 2020.
The year 2769 of the Nabonassar begins on April 18, 2020.
The year 2332 of the Seleucidean era begins in the present-day usage of the Syrians on September 14 or October 14, 2020 according to different sects.
The Gregorian Year 2020 begins on January 1, 2020.

CALENDAR, 2020

Day of Month	Day of Year	Day of Week	Days since J 2020.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar Day of Month	Indian Calendar Day of Year	Phases of the Moon
					2458	1941 Saka Era		
Dec. 28	362	Sat	-187.125	-0.0110	845.5	Pausha 7	282	
29	363	Sun	186.125	-0.0082	846.5	8	283	
30	364	Mon	185.125	-0.0055	847.5	9	284	
Dec. 31	365	Tue	184.125	-0.0027	848.5	10	285	
Jan. 1	1	Wed	183.125	0.0000	849.5	11	286	
2	2	Thu	182.125	0.0027	850.5	12	287	
3	3	Fri	181.125	0.0055	851.5	13	288	3-First Quarter 4^h 45^m U.T.
4	4	Sat	-180.125	0.0082	852.5	14	289	
5	5	Sun	179.125	0.0110	853.5	15	290	
6	6	Mon	178.125	0.0137	854.5	16	291	
7	7	Tue	177.125	0.0164	855.5	17	292	
8	8	Wed	176.125	0.0192	856.5	18	293	
9	9	Thu	175.125	0.0219	857.5	19	294	
10	10	Fri	174.125	0.0246	858.5	20	295	10-Full Moon 19^h 21^m U.T.
11	11	Sat	-173.125	0.0274	859.5	21	296	
12	12	Sun	172.125	0.0301	860.5	22	297	
13	13	Mon	171.125	0.0329	861.5	23	298	
14	14	Tue	170.125	0.0356	862.5	24	299	
15	15	Wed	169.125	0.0383	863.5	25	300	
16	16	Thu	168.125	0.0411	864.5	26	301	
17	17	Fri	167.125	0.0438	865.5	27	302	17-Last Quarter 12^h 58^m U.T.
18	18	Sat	-166.125	0.0465	866.5	28	303	
19	19	Sun	165.125	0.0493	867.5	29	304	
20	20	Mon	164.125	0.0520	868.5	30	305	
21	21	Tue	163.125	0.0548	869.5	Magha 1	306	
22	22	Wed	162.125	0.0575	870.5	2	307	
23	23	Thu	161.125	0.0602	871.5	3	308	
24	24	Fri	160.125	0.0630	872.5	4	309	24-New Moon 21^h 42^m U.T.
25	25	Sat	-159.125	0.0657	873.5	5	310	
26	26	Sun	158.125	0.0684	874.5	6	311	
27	27	Mon	157.125	0.0712	875.5	7	312	
28	28	Tue	156.125	0.0739	876.5	8	313	
29	29	Wed	155.125	0.0767	877.5	9	314	
30	30	Thu	154.125	0.0794	878.5	10	315	
31	31	Fri	153.125	0.0821	879.5	11	316	
Feb. 1	32	Sat	-152.125	0.0849	880.5	12	317	
2	33	Sun	151.125	0.0876	881.5	13	318	2-First Quarter 1^h 42^m U.T.
3	34	Mon	150.125	0.0904	882.5	14	319	
4	35	Tue	149.125	0.0931	883.5	15	320	
5	36	Wed	148.125	0.0958	884.5	16	321	
6	37	Thu	147.125	0.0986	885.5	17	322	
7	38	Fri	-146.125	0.1013	886.5	18	323	

CALENDAR, 2020

Day of Month	Day of Year	Day of Week	Days since J 2020.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar: Day of Month	Indian Calendar: Day of Year	Phases of the Moon
					2458	1941 Saka Era		
Feb. 8	39	Sat	-145.125	0.1040	887.5	Magha 19	324	
9	40	Sun	144.125	0.1068	888.5	20	325	9-Full Moon
10	41	Mon	143.125	0.1095	889.5	21	326	$7^h\ 33^m$ U.T.
11	42	Tue	142.125	0.1123	890.5	22	327	
12	43	Wed	141.125	0.1150	891.5	23	328	
13	44	Thu	140.125	0.1177	892.5	24	329	
14	45	Fri	139.125	0.1205	893.5	25	330	
15	46	Sat	-138.125	0.1232	894.5	26	331	15-Last Quarter
16	47	Sun	137.125	0.1259	895.5	27	332	$22^h\ 17^m$ U.T.
17	48	Mon	136.125	0.1287	896.5	28	333	
18	49	Tue	135.125	0.1314	897.5	29	334	
19	50	Wed	134.125	0.1342	898.5	30	335	
20	51	Thu	133.125	0.1369	899.5	Phalguna 1	336	
21	52	Fri	132.125	0.1396	900.5	2	337	
22	53	Sat	-131.125	0.1424	901.5	3	338	
23	54	Sun	130.125	0.1451	902.5	4	339	23-New Moon
24	55	Mon	129.125	0.1478	903.5	5	340	$15^h\ 32^m$ U.T.
25	56	Tue	128.125	0.1506	904.5	6	341	
26	57	Wed	127.125	0.1533	905.5	7	342	
27	58	Thu	126.125	0.1561	906.5	8	343	
28	59	Fri	125.125	0.1588	907.5	9	344	
29	60	Sat	-124.125	0.1615	908.5	10	345	
Mar. 1	61	Sun	123.125	0.1643	909.5	11	346	
2	62	Mon	122.125	0.1670	910.5	12	347	2-First Quarter
3	63	Tue	121.125	0.1698	911.5	13	348	$19^h\ 57^m$ U.T.
4	64	Wed	120.125	0.1725	912.5	14	349	
5	65	Thu	119.125	0.1752	913.5	15	350	
6	66	Fri	118.125	0.1780	914.5	16	351	
7	67	Sat	-117.125	0.1807	915.5	17	352	
8	68	Sun	116.125	0.1834	916.5	18	353	
9	69	Mon	115.125	0.1862	917.5	19	354	9-Full Moon
10	70	Tue	114.125	0.1889	918.5	20	355	$17^h\ 48^m$ U.T.
11	71	Wed	113.125	0.1917	919.5	21	356	
12	72	Thu	112.125	0.1944	920.5	22	357	
13	73	Fri	111.125	0.1971	921.5	23	358	
14	74	Sat	-110.125	0.1999	922.5	24	359	
15	75	Sun	109.125	0.2026	923.5	25	360	
16	76	Mon	108.125	0.2053	924.5	26	361	16-Last Quarter
17	77	Tue	107.125	0.2081	925.5	27	362	$9^h\ 34^m$ U.T.
18	78	Wed	106.125	0.2108	926.5	28	363	
19	79	Thu	105.125	0.2136	927.5	29	364	
20	80	Fri	-104.125	0.2163	928.5	30	365	

CALENDAR, 2020

Day of Month	Day of Year	Day of Week	Days since J 2020.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar		Phases of the Moon
						Day of Month	Day of Year	
					2458	1942 Saka Era		
Mar. 21	81	Sat	-103.125	0.2190	929.5	Chaitra 1	1	
22	82	Sun	102.125	0.2218	930.5	2	2	
23	83	Mon	101.125	0.2245	931.5	3	3	
24	84	Tue	100.125	0.2272	932.5	4	4	24-New Moon
25	85	Wed	99.125	0.2300	933.5	5	5	9^h 28^m U.T.
26	86	Thu	98.125	0.2327	934.5	6	6	
27	87	Fri	97.125	0.2355	935.5	7	7	
28	88	Sat	-96.125	0.2382	936.5	8	8	
29	89	Sun	95.125	0.2409	937.5	9	9	
30	90	Mon	94.125	0.2437	938.5	10	10	
31	91	Tue	93.125	0.2464	939.5	11	11	
Apr. 1	92	Wed	92.125	0.2491	940.5	12	12	1-First Quarter
2	93	Thu	91.125	0.2519	941.5	13	13	10^h 21^m U.T.
3	94	Fri	90.125	0.2546	942.5	14	14	
4	95	Sat	-89.125	0.2574	943.5	15	15	
5	96	Sun	88.125	0.2601	944.5	16	16	
6	97	Mon	87.125	0.2628	945.5	17	17	
7	98	Tue	86.125	0.2656	946.5	18	18	
8	99	Wed	85.125	0.2683	947.5	19	19	8-Full Moon
9	100	Thu	84.125	0.2711	948.5	20	20	2^h 35^m U.T.
10	101	Fri	83.125	0.2738	949.5	21	21	
11	102	Sat	-82.125	0.2765	950.5	22	22	
12	103	Sun	81.125	0.2793	951.5	23	23	
13	104	Mon	80.125	0.2820	952.5	24	24	
14	105	Tue	79.125	0.2847	953.5	25	25	14-Last Quarter
15	106	Wed	78.125	0.2875	954.5	26	26	22^h 56^m U.T.
16	107	Thu	77.125	0.2902	955.5	27	27	
17	108	Fri	76.125	0.2930	956.5	28	28	
18	109	Sat	-75.125	0.2957	957.5	29	29	
19	110	Sun	74.125	0.2984	958.5	30	30	
20	111	Mon	73.125	0.3012	959.5	31	31	
21	112	Tue	72.125	0.3039	960.5	Vaisakha 1	32	
22	113	Wed	71.125	0.3066	961.5	2	33	
23	114	Thu	70.125	0.3094	962.5	3	34	23-New Moon
24	115	Fri	69.125	0.3121	963.5	4	35	2^h 26^m U.T.
25	116	Sat	-68.125	0.3149	964.5	5	36	
26	117	Sun	67.125	0.3176	965.5	6	37	
27	118	Mon	66.125	0.3203	966.5	7	38	
28	119	Tue	65.125	0.3231	967.5	8	39	
29	120	Wed	64.125	0.3258	968.5	9	40	
30	121	Thu	63.125	0.3285	969.5	10	41	30-First Quarter
May 1	122	Fri	-62.125	0.3313	970.5	11	42	20^h 38^m U.T.

CALENDAR, 2020

Day of Month		Day of Year	Day of Week	Days since J 2020.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar: Day of Month	Indian Calendar: Day of Year	Phases of the Moon
						2458	1942 Saka Era		
May	2	123	Sat	-61.125	0.3340	971.5	Vaisakha 12	43	
	3	124	Sun	60.125	0.3368	972.5	13	44	
	4	125	Mon	59.125	0.3395	973.5	14	45	
	5	126	Tue	58.125	0.3422	974.5	15	46	
	6	127	Wed	57.125	0.3450	975.5	16	47	
	7	128	Thu	56.125	0.3477	976.5	17	48	7-Full Moon
	8	129	Fri	55.125	0.3505	977.5	18	49	10^h 45^m U.T.
	9	130	Sat	-54.125	0.3532	978.5	19	50	
	10	131	Sun	53.125	0.3559	979.5	20	51	
	11	132	Mon	52.125	0.3587	980.5	21	52	
	12	133	Tue	51.125	0.3614	981.5	22	53	
	13	134	Wed	50.125	0.3641	982.5	23	54	
	14	135	Thu	49.125	0.3669	983.5	24	55	14-Last Quarter
	15	136	Fri	48.125	0.3696	984.5	25	56	14^h 03^m U.T.
	16	137	Sat	-47.125	0.3724	985.5	26	57	
	17	138	Sun	46.125	0.3751	986.5	27	58	
	18	139	Mon	45.125	0.3778	987.5	28	59	
	19	140	Tue	44.125	0.3806	988.5	29	60	
	20	141	Wed	43.125	0.3833	989.5	30	61	
	21	142	Thu	42.125	0.3860	990.5	31	62	
	22	143	Fri	41.125	0.3888	991.5	Jyaistha 1	63	22-New Moon 17^h 39^m U.T.
	23	144	Sat	-40.125	0.3915	992.5	2	64	
	24	145	Sun	39.125	0.3943	993.5	3	65	
	25	146	Mon	38.125	0.3970	994.5	4	66	
	26	147	Tue	37.125	0.3997	995.5	5	67	
	27	148	Wed	36.125	0.4025	996.5	6	68	
	28	149	Thu	35.125	0.4052	997.5	7	69	
	29	150	Fri	34.125	0.4079	998.5	8	70	
	30	151	Sat	-33.125	0.4107	999.5	9	71	30-First Quarter
	31	152	Sun	32.125	0.4134	2459000.5	10	72	3^h 30^m U.T.
June	1	153	Mon	31.125	0.4162	001.5	11	73	
	2	154	Tue	30.125	0.4189	002.5	12	74	
	3	155	Wed	29.125	0.4216	003.5	13	75	
	4	156	Thu	28.125	0.4244	004.5	14	76	
	5	157	Fri	27.125	0.4271	005.5	15	77	5-Full Moon 19^h 12^m U.T.
	6	158	Sat	-26.125	0.4299	006.5	16	78	
	7	159	Sun	25.125	0.4326	007.5	17	79	
	8	160	Mon	24.125	0.4353	008.5	18	80	
	9	161	Tue	23.125	0.4381	009.5	19	81	
	10	162	Wed	22.125	0.4408	010.5	20	82	
	11	163	Thu	21.125	0.4435	011.5	21	83	
	12	164	Fri	-20.125	0.4463	012.5	22	84	

CALENDAR, 2020

Day of Month	Day of Year	Day of Week	Days since J 2020.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar Day of Month	Indian Calendar Day of Year	Phases of the Moon
					2459	1942 Saka Era		
June 13	165	Sat	-19.125	0.4490	013.5l	Jyaishtha 23	85	13-Last Quarter
14	166	Sun	18.125	0.4518	014.5l	24	86	6^h 24^m U.T.
15	167	Mon	17.125	0.4545	015.5l	25	87	
16	168	Tue	16.125	0.4572	016.5l	26	88	
17	169	Wed	15.125	0.4600	017.5l	27	89	
18	170	Thu	14.125	0.4627	018.5l	28	90	
19	171	Fri	13.125	0.4654	019.5l	29	91	
20	172	Sat	-12.125	0.4682	020.5l	30	92	
21	173	Sun	11.125	0.4709	021.5l	31	93	21-New Moon
22	174	Mon	10.125	0.4737	022.5l	Ashadha 1	94	6^h 41^m U.T.
23	175	Tue	9.125	0.4764	023.5l	2	95	
24	176	Wed	8.125	0.4791	024.5l	3	96	
25	177	Thu	7.125	0.4819	025.5l	4	97	
26	178	Fri	6.125	0.4846	026.5l	5	98	
27	179	Sat	-5.125	0.4873	027.5l	6	99	
28	180	Sun	4.125	0.4901	028.5l	7	100	28-First Quarter
29	181	Mon	3.125	0.4928	029.5l	8	101	8^h 16^m U.T.
30	182	Tue	2.125	0.4956	030.5l	9	102	
July 1	183	Wed	1.125	0.4983	031.5l	10	103	
2	184	Thu	-0.125	0.5010	032.5l	11	104	
3	185	Fri	+0.875	0.5038	033.5l	12	105	
4	186	Sat	+1.875	0.5065	034.5l	13	106	
5	187	Sun	2.875	0.5093	035.5l	14	107	5-Full Moon
6	188	Mon	3.875	0.5120	036.5l	15	108	4^h 44^m U.T.
7	189	Tue	4.875	0.5147	037.5l	16	109	
8	190	Wed	5.875	0.5175	038.5l	17	110	
9	191	Thu	6.875	0.5202	039.5l	18	111	
10	192	Fri	7.875	0.5229	040.5l	19	112	
11	193	Sat	+8.875	0.5257	041.5l	20	113	
12	194	Sun	9.875	0.5284	042.5l	21	114	12-Last Quarter
13	195	Mon	10.875	0.5312	043.5l	22	115	23^h 29^m U.T.
14	196	Tue	11.875	0.5339	044.5l	23	116	
15	197	Wed	12.875	0.5366	045.5l	24	117	
16	198	Thu	13.875	0.5394	046.5l	25	118	
17	199	Fri	14.875	0.5421	047.5l	26	119	
18	200	Sat	+15.875	0.5448	048.5l	27	120	
19	201	Sun	16.875	0.5476	049.5l	28	121	
20	202	Mon	17.875	0.5503	050.5l	29	122	20-New Moon
21	203	Tue	18.875	0.5531	051.5l	30	123	17^h 33^m U.T.
22	204	Wed	19.875	0.5558	052.5l	31	124	
23	205	Thu	20.875	0.5585	053.5l	Sravana 1	125	
24	206	Fri	+21.875	0.5613	054.5l	2	126	

CALENDAR, 2020

Day of Month		Day of Year	Day of Week	Days since J 2020.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar: Day of Month	Indian Calendar: Day of Year	Phases of the Moon
						2459	1942 Saka Era		
July	25	207	Sat	+22.875	0.5640	055.5	Sravana 3	127	
	26	208	Sun	23.875	0.5667	056.5	4	128	
	27	209	Mon	24.875	0.5695	057.5	5	129	27-First Quarter
	28	210	Tue	25.875	0.5722	058.5	6	130	$12^h\ 33^m$ U.T.
	29	211	Wed	26.875	0.5750	059.5	7	131	
	30	212	Thu	27.875	0.5777	060.5	8	132	
	31	213	Fri	28.875	0.5804	061.5	9	133	
Aug.	1	214	Sat	+29.875	0.5832	062.5	10	134	
	2	215	Sun	30.875	0.5859	063.5	11	135	
	3	216	Mon	31.875	0.5887	064.5	12	136	3-Full Moon
	4	217	Tue	32.875	0.5914	065.5	13	137	$15^h\ 59^m$ U.T.
	5	218	Wed	33.875	0.5941	066.5	14	138	
	6	219	Thu	34.875	0.5969	067.5	15	139	
	7	220	Fri	35.875	0.5996	068.5	16	140	
	8	221	Sat	+36.875	0.6023	069.5	17	141	
	9	222	Sun	37.875	0.6051	070.5	18	142	
	10	223	Mon	38.875	0.6078	071.5	19	143	
	11	224	Tue	39.875	0.6106	072.5	20	144	11-Last Quarter
	12	225	Wed	40.875	0.6133	073.5	21	145	$16^h\ 45^m$ U.T.
	13	226	Thu	41.875	0.6160	074.5	22	146	
	14	227	Fri	42.875	0.6188	075.5	23	147	
	15	228	Sat	+43.875	0.6215	076.5	24	148	
	16	229	Sun	44.875	0.6242	077.5	25	149	
	17	230	Mon	45.875	0.6270	078.5	26	150	
	18	231	Tue	46.875	0.6297	079.5	27	151	
	19	232	Wed	47.875	0.6325	080.5	28	152	19-New Moon
	20	233	Thu	48.875	0.6352	081.5	29	153	$2^h\ 42^m$ U.T.
	21	234	Fri	49.875	0.6379	082.5	30	154	
	22	235	Sat	+50.875	0.6407	083.5	31	155	
	23	236	Sun	51.875	0.6434	084.5	Bhadra 1	156	
	24	237	Mon	52.875	0.6461	085.5	2	157	
	25	238	Tue	53.875	0.6489	086.5	3	158	25-First Quarter
	26	239	Wed	54.875	0.6516	087.5	4	159	$17^h\ 58^m$ U.T.
	27	240	Thu	55.875	0.6544	088.5	5	160	
	28	241	Fri	56.875	0.6571	089.5	6	161	
	29	242	Sat	+57.875	0.6598	090.5	7	162	
	30	243	Sun	58.875	0.6626	091.5	8	163	
	31	244	Mon	59.875	0.6653	092.5	9	164	
Sept.	1	245	Tue	60.875	0.6680	093.5	10	165	
	2	246	Wed	61.875	0.6708	094.5	11	166	2-Full Moon
	3	247	Thu	62.875	0.6735	095.5	12	167	$5^h\ 22^m$ U.T.
	4	248	Fri	+63.875	0.6763	096.5	13	168	

CALENDAR, 2020

Day of Month		Day of Year	Day of Week	Days since J 2020.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar: Day of Month	Indian Calendar: Day of Year	Phases of the Moon
						2459	1942 Saka Era		
Sept.	5	249	Sat	+64.875	0.6790	097.5	Bhadra 14	169	
	6	250	Sun	65.875	0.6817	098.5	15	170	
	7	251	Mon	66.875	0.6845	099.5	16	171	
	8	252	Tue	67.875	0.6872	100.5	17	172	
	9	253	Wed	68.875	0.6900	101.5	18	173	
	10	254	Thu	69.875	0.6927	102.5	19	174	10-Last Quarter
	11	255	Fri	70.875	0.6954	103.5	20	175	$9^h\ 26^m$ U.T.
	12	256	Sat	+71.875	0.6982	104.5	21	176	
	13	257	Sun	72.875	0.7009	105.5	22	177	
	14	258	Mon	73.875	0.7036	106.5	23	178	
	15	259	Tue	74.875	0.7064	107.5	24	179	
	16	260	Wed	75.875	0.7091	108.5	25	180	
	17	261	Thu	76.875	0.7119	109.5	26	181	17-New Moon
	18	262	Fri	77.875	0.7146	110.5	27	182	$11^h\ 00^m$ U.T.
	19	263	Sat	+78.875	0.7173	111.5	28	183	
	20	264	Sun	79.875	0.7201	112.5	29	184	
	21	265	Mon	80.875	0.7228	113.5	30	185	
	22	266	Tue	81.875	0.7255	114.5	31	186	
	23	267	Wed	82.875	0.7283	115.5	Asvina 1	187	
	24	268	Thu	83.875	0.7310	116.5	2	188	24-First Quarter
	25	269	Fri	84.875	0.7338	117.5	3	189	$1^h\ 55^m$ U.T.
	26	270	Sat	+85.875	0.7365	118.5	4	190	
	27	271	Sun	86.875	0.7392	119.5	5	191	
	28	272	Mon	87.875	0.7420	120.5	6	192	
	29	273	Tue	88.875	0.7447	121.5	7	193	
	30	274	Wed	89.875	0.7474	122.5	8	194	
Oct.	1	275	Thu	90.875	0.7502	123.5	9	195	1-Full Moon
	2	276	Fri	91.875	0.7529	124.5	10	196	$21^h\ 05^m$ U.T.
	3	277	Sat	+92.875	0.7557	125.5	11	197	
	4	278	Sun	93.875	0.7584	126.5	12	198	
	5	279	Mon	94.875	0.7611	127.5	13	199	
	6	280	Tue	95.875	0.7639	128.5	14	200	
	7	281	Wed	96.875	0.7666	129.5	15	201	
	8	282	Thu	97.875	0.7694	130.5	16	202	
	9	283	Fri	98.875	0.7721	131.5	17	203	
	10	284	Sat	+99.875	0.7748	132.5	18	204	10-Last Quarter
	11	285	Sun	100.875	0.7776	133.5	19	205	$0^h\ 40^m$ U.T.
	12	286	Mon	101.875	0.7803	134.5	20	206	
	13	287	Tue	102.875	0.7830	135.5	21	207	
	14	288	Wed	103.875	0.7858	136.5	22	208	
	15	289	Thu	104.875	0.7885	137.5	23	209	
	16	290	Fri	+105.875	0.7913	138.5	24	210	16-New Moon $19^h\ 31^m$ U.T.

CALENDAR, 2020

Day of Month		Day of Year	Day of Week	Days since J 2020.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar: Day of Month	Indian Calendar: Day of Year	Phases of the Moon
						2459	1942 Saka Era		
Oct.	17	291	Sat	+106.875	0.7940	139.5	Asvina 25	211	
	18	292	Sun	107.875	0.7967	140.5	26	212	
	19	293	Mon	108.875	0.7995	141.5	27	213	
	20	294	Tue	109.875	0.8022	142.5	28	214	
	21	295	Wed	110.875	0.8049	143.5	29	215	
	22	296	Thu	111.875	0.8077	144.5	30	216	
	23	297	Fri	112.875	0.8104	145.5	Kartika 1	217	23-First Quarter $13^h 23^m$ U.T.
	24	298	Sat	+113.875	0.8132	146.5	2	218	
	25	299	Sun	114.875	0.8159	147.5	3	219	
	26	300	Mon	115.875	0.8186	148.5	4	220	
	27	301	Tue	116.875	0.8214	149.5	5	221	
	28	302	Wed	117.875	0.8241	150.5	6	222	
	29	303	Thu	118.875	0.8268	151.5	7	223	
	30	304	Fri	119.875	0.8296	152.5	8	224	
	31	305	Sat	+120.875	0.8323	153.5	9	225	31-Full Moon
Nov.	1	306	Sun	121.875	0.8351	154.5	10	226	$14^h 49^m$ U.T.
	2	307	Mon	122.875	0.8378	155.5	11	227	
	3	308	Tue	123.875	0.8405	156.5	12	228	
	4	309	Wed	124.875	0.8433	157.5	13	229	
	5	310	Thu	125.875	0.8460	158.5	14	230	
	6	311	Fri	126.875	0.8488	159.5	15	231	
	7	312	Sat	+127.875	0.8515	160.5	16	232	
	8	313	Sun	128.875	0.8542	161.5	17	233	8-Last Quarter
	9	314	Mon	129.875	0.8570	162.5	18	234	$13^h 46^m$ U.T.
	10	315	Tue	130.875	0.8597	163.5	19	235	
	11	316	Wed	131.875	0.8624	164.5	20	236	
	12	317	Thu	132.875	0.8652	165.5	21	237	
	13	318	Fri	133.875	0.8679	166.5	22	238	
	14	319	Sat	+134.875	0.8707	167.5	23	239	
	15	320	Sun	135.875	0.8734	168.5	24	240	15-New Moon
	16	321	Mon	136.875	0.8761	169.5	25	241	$5^h 07^m$ U.T.
	17	322	Tue	137.875	0.8789	170.5	26	242	
	18	323	Wed	138.875	0.8816	171.5	27	243	
	19	324	Thu	139.875	0.8843	172.5	28	244	
	20	325	Fri	140.875	0.8871	173.5	29	245	
	21	326	Sat	+141.875	0.8898	174.5	30	246	
	22	327	Sun	142.875	0.8926	175.5	Agrahayana 1	247	22-First Quarter
	23	328	Mon	143.875	0.8953	176.5	2	248	$4^h 45^m$ U.T.
	24	329	Tue	144.875	0.8980	177.5	3	249	
	25	330	Wed	145.875	0.9008	178.5	4	250	
	26	331	Thu	146.875	0.9035	179.5	5	251	
	27	332	Fri	+147.875	0.9062	180.5	6	252	

CALENDAR, 2020

Day of Month		Day of Year	Day of Week	Days since J 2020.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar Day of Month	Indian Calendar Day of Year	Phases of the Moon
						2459	1942 Saka Era		
Nov.	28	333	Sat	+148.875	0.9090	181.5	Agrahayana 7	253	
	29	334	Sun	149.875	0.9117	182.5	8	254	
	30	335	Mon	150.875	0.9145	183.5	9	255	30-Full Moon
Dec.	1	336	Tue	151.875	0.9172	184.5	10	256	$9^h\ 30^m$ U.T.
	2	337	Wed	152.875	0.9199	185.5	11	257	
	3	338	Thu	153.875	0.9227	186.5	12	258	
	4	339	Fri	154.875	0.9254	187.5	13	259	
	5	340	Sat	+155.875	0.9282	188.5	14	260	
	6	341	Sun	156.875	0.9309	189.5	15	261	
	7	342	Mon	157.875	0.9336	190.5	16	262	
	8	343	Tue	158.875	0.9364	191.5	17	263	8-Last Quarter
	9	344	Wed	159.875	0.9391	192.5	18	264	$0^h\ 37^m$ U.T.
	10	345	Thu	160.875	0.9418	193.5	19	265	
	11	346	Fri	161.875	0.9446	194.5	20	266	
	12	347	Sat	+162.875	0.9473	195.5	21	267	
	13	348	Sun	163.875	0.9501	196.5	22	268	
	14	349	Mon	164.875	0.9528	197.5	23	269	14-New Moon
	15	350	Tue	165.875	0.9555	198.5	24	270	$16^h\ 17^m$ U.T.
	16	351	Wed	166.875	0.9583	199.5	25	271	
	17	352	Thu	167.875	0.9610	200.5	26	272	
	18	353	Fri	168.875	0.9637	201.5	27	273	
	19	354	Sat	+169.875	0.9665	202.5	28	274	
	20	355	Sun	170.875	0.9692	203.5	29	275	
	21	356	Mon	171.875	0.9720	204.5	30	276	21-First Quarter
	22	357	Tue	172.875	0.9747	205.5	Pausha 1	277	$23^h\ 41^m$ U.T.
	23	358	Wed	173.875	0.9774	206.5	2	278	
	24	359	Thu	174.875	0.9802	207.5	3	279	
	25	360	Fri	175.875	0.9829	208.5	4	280	
	26	361	Sat	+176.875	0.9856	209.5	5	281	
	27	362	Sun	177.875	0.9884	210.5	6	282	
	28	363	Mon	178.875	0.9911	211.5	7	283	
	29	364	Tue	179.875	0.9939	212.5	8	284	
	30	365	Wed	180.875	0.9966	213.5	9	285	30-Full Moon
	31	366	Thu	181.875	0.9993	214.5	10	286	$3^h\ 28^m$ U.T.
	32	1	Fri	+182.875	1.0021	215.5	11	287	

The new epoch is the middle of the Julian year, denoted by J 2020.5 (i.e. 2020, July 2.125) where the length of the Julian year is taken to be 365.25 days.

The Fraction of year is reckoned from January 1, 0^h U.T and is based on the tropical year of 365.2422 days. The Julian Day begins at noon. In order to obtain the Julian Day Number completed at noon as given in Table IX, increase the above figure by 0.5.

The Day of year of the Gregorian Calendar is reckoned from January 1, and that of the Indian Calendar from Chaitra 1.

SIDEREAL TIME, 2020

Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinoxes at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)			Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinoxes at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)		
		h	m	s	s	h	m	s			h	m	s	s	h	m	s
Jan.	0	6	36	32.679	-1.007	17	20	36.376	Feb.	15	9	37	54.226	-0.979	14	19	44.540
	1	6	40	29.234	1.009	17	16	40.467		16	9	41	50.781	0.979	14	15	48.631
	2	6	44	25.790	1.012	17	12	44.557		17	9	45	47.337	0.977	14	11	52.721
	3	6	48	22.345	1.015	17	08	48.648		18	9	49	43.892	0.973	14	07	56.812
	4	6	52	18.900	1.019	17	04	52.738		19	9	53	40.447	0.968	14	04	00.902
	5	6	56	15.456	1.021	17	00	56.829		20	9	57	37.003	0.964	14	00	04.993
	6	7	00	12.011	-1.021	16	57	00.919		21	10	01	33.558	-0.962	23	54	30.788
	7	7	04	08.567	1.018	16	53	05.010		22	10	05	30.114	0.962	23	50	34.879
	8	7	08	05.122	1.013	16	49	09.100		23	10	09	26.669	0.964	23	46	38.969
	9	7	12	01.677	1.005	16	45	13.191		24	10	13	23.224	0.969	23	42	43.060
	10	7	15	58.233	0.995	16	41	17.281		25	10	17	19.780	0.976	23	38	47.150
	11	7	19	54.788	0.986	16	37	21.372		26	10	21	16.335	0.984	23	34	51.241
	12	7	23	51.343	-0.978	16	33	25.462		27	10	25	12.890	-0.993	23	30	55.331
	13	7	27	47.899	0.974	16	29	29.553		28	10	29	09.446	1.000	23	26	59.422
	14	7	31	44.454	0.973	16	25	33.643		29	10	33	06.001	1.007	23	23	03.512
	15	7	35	41.010	0.976	16	21	37.734	Mar.	1	10	37	02.556	1.011	23	19	07.603
	16	7	39	37.565	0.980	16	17	41.825		2	10	40	59.112	1.012	23	15	11.693
	17	7	43	34.120	0.985	16	13	45.915		3	10	44	55.667	1.012	23	11	15.784
	18	7	47	30.676	-0.987	16	09	50.006		4	10	48	52.223	-1.009	23	07	19.874
	19	7	51	27.231	0.988	16	05	54.096		5	10	52	48.778	1.004	23	03	23.965
	20	7	55	23.786	0.985	16	01	58.187		6	10	56	45.333	1.000	22	59	28.055
	21	7	59	20.342	0.980	15	58	02.277		7	11	00	41.889	0.998	22	55	32.146
	22	8	03	16.897	0.972	15	54	06.368		8	11	04	38.444	0.998	22	51	36.237
	23	8	07	13.452	0.965	15	50	10.458		9	11	08	34.999	1.002	22	47	40.327
	24	8	11	10.008	-0.959	15	46	14.549		10	11	12	31.555	-1.010	22	43	44.418
	25	8	15	06.563	0.954	15	42	18.639		11	11	16	28.110	1.019	22	39	48.508
	26	8	19	03.119	0.952	15	38	22.730		12	11	20	24.666	1.028	22	35	52.599
	27	8	22	59.674	0.953	15	34	26.820		13	11	24	21.221	1.034	22	31	56.689
	28	8	26	56.229	0.956	15	30	30.911		14	11	28	17.776	1.037	22	28	00.780
	29	8	30	52.785	0.960	15	26	35.001		15	11	32	14.332	1.037	22	24	04.870
	30	8	34	49.340	-0.966	15	22	39.092		16	11	36	10.887	-1.034	22	20	08.961
	31	8	38	45.895	0.972	15	18	43.182		17	11	40	07.442	1.030	22	16	13.051
Feb.	1	8	42	42.451	0.976	15	14	47.273		18	11	44	03.998	1.027	22	12	17.142
	2	8	46	39.006	0.979	15	10	51.364		19	11	47	60.553	1.026	22	08	21.232
	3	8	50	35.562	0.980	15	06	55.454		20	11	51	57.108	1.026	22	04	25.323
	4	8	54	32.117	0.979	15	02	59.545		21	11	55	53.664	1.029	22	00	29.413
	5	8	58	28.672	-0.974	14	59	03.635		22	11	59	50.219	-1.035	21	56	33.504
	6	9	02	25.228	0.968	14	55	07.726		23	12	03	46.775	1.043	21	52	37.594
	7	9	06	21.783	0.961	14	51	11.816		24	12	07	43.330	1.051	21	48	41.685
	8	9	10	18.338	0.955	14	47	15.907		25	12	11	39.885	1.060	21	44	45.775
	9	9	14	14.894	0.951	14	43	19.997		26	12	15	36.441	1.069	21	40	49.866
	10	9	18	11.449	0.951	14	39	24.088		27	12	19	32.996	1.076	21	36	53.957
	11	9	22	08.004	-0.955	14	35	28.178		28	12	23	29.551	-1.082	21	32	58.047
	12	9	26	04.560	0.962	14	31	32.269		29	12	27	26.107	1.084	21	29	02.138
	13	9	30	01.115	0.969	14	27	36.359		30	12	31	22.662	1.085	21	25	06.228
	14	9	33	57.671	0.975	14	23	40.450		31	12	35	19.218	1.083	21	21	10.319
	15	9	37	54.226	-0.979	14	19	44.540	Apr.	1	12	39	15.773	-1.080	21	17	14.409

N.B.-Apparent Sidereal Time = Mean Sidereal Time + Equation of Equinoxes for the instant

SIDEREAL TIME, 2020

Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinoxes at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)			Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinoxes at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)		
		h	m	s	s	h	m	s			h	m	s	s	h	m	s
Apr.	1	12	39	15.773	-1.080	21	17	14.409	May	17	15	40	37.320	-1.111	18	16	22.574
	2	12	43	12.328	1.076	21	13	18.500		18	15	44	33.875	1.117	18	12	26.664
	3	12	47	08.884	1.073	21	09	22.590		19	15	48	30.431	1.122	18	08	30.755
	4	12	51	05.439	1.072	21	05	26.681		20	15	52	26.986	1.126	18	04	34.845
	5	12	55	01.994	1.075	21	01	30.771		21	15	56	23.541	1.129	18	00	38.936
	6	12	58	58.550	1.081	20	57	34.862		22	16	00	20.097	1.129	17	56	43.026
	7	13	02	55.105	-1.090	20	53	38.952		23	16	04	16.652	-1.126	17	52	47.117
	8	13	06	51.660	1.098	20	49	43.043		24	16	08	13.207	1.121	17	48	51.207
	9	13	10	48.216	1.106	20	45	47.133		25	16	12	09.763	1.114	17	44	55.298
	10	13	14	44.771	1.109	20	41	51.224		26	16	16	06.318	1.106	17	40	59.388
	11	13	18	41.327	1.109	20	37	55.315		27	16	20	02.874	1.099	17	37	03.479
	12	13	22	37.882	1.105	20	33	59.405		28	16	23	59.429	1.094	17	33	07.569
	13	13	26	34.437	-1.100	20	30	03.496		29	16	27	55.984	-1.091	17	29	11.660
	14	13	30	30.993	1.096	20	26	07.586		30	16	31	52.540	1.091	17	25	15.750
	15	13	34	27.548	1.092	20	22	11.677		31	16	35	49.095	1.094	17	21	19.841
	16	13	38	24.103	1.091	20	18	15.767	June	1	16	39	45.650	1.098	17	17	23.932
	17	13	42	20.659	1.092	20	14	19.858		2	16	43	42.206	1.103	17	13	28.022
	18	13	46	17.214	1.096	20	10	23.948		3	16	47	38.761	1.105	17	09	32.113
	19	13	50	13.770	-1.102	20	06	28.039		4	16	51	35.316	-1.104	17	05	36.203
	20	13	54	10.325	1.109	20	02	32.129		5	16	55	31.872	1.099	17	01	40.294
	21	13	58	06.880	1.117	19	58	36.220		6	16	59	28.427	1.091	16	57	44.384
	22	14	02	03.436	1.124	19	54	40.310		7	17	03	24.983	1.081	16	53	48.475
	23	14	05	59.991	1.130	19	50	44.401		8	17	07	21.538	1.072	16	49	52.565
	24	14	09	56.546	1.134	19	46	48.491		9	17	11	18.093	1.064	16	45	56.656
	25	14	13	53.102	-1.136	19	42	52.582		10	17	15	14.649	-1.059	16	42	00.746
	26	14	17	49.657	1.135	19	38	56.673		11	17	19	11.204	1.056	16	38	04.837
	27	14	21	46.212	1.132	19	35	00.763		12	17	23	07.759	1.057	16	34	08.927
	28	14	25	42.768	1.127	19	31	04.854		13	17	27	04.315	1.060	16	30	13.018
	29	14	29	39.323	1.122	19	27	08.944		14	17	30	60.870	1.063	16	26	17.108
	30	14	33	35.879	1.117	19	23	13.035		15	17	34	57.426	1.067	16	22	21.199
May	1	14	37	32.434	-1.114	19	19	17.125		16	17	38	53.981	-1.071	16	18	25.290
	2	14	41	28.989	1.114	19	15	21.216		17	17	42	50.536	1.073	16	14	29.380
	3	14	45	25.545	1.117	19	11	25.306		18	17	46	47.092	1.072	16	10	33.471
	4	14	49	22.100	1.122	19	07	29.397		19	17	50	43.647	1.069	16	06	37.561
	5	14	53	18.655	1.129	19	03	33.487		20	17	54	40.202	1.064	16	02	41.652
	6	14	57	15.211	1.135	18	59	37.578		21	17	58	36.758	1.056	15	58	45.742
	7	15	01	11.766	-1.138	18	55	41.668		22	18	02	33.313	-1.047	15	54	49.833
	8	15	05	08.322	1.137	18	51	45.759		23	18	06	29.868	1.039	15	50	53.923
	9	15	09	04.877	1.133	18	47	49.849		24	18	10	26.424	1.031	15	46	58.014
	10	15	13	01.432	1.125	18	43	53.940		25	18	14	22.979	1.027	15	43	02.104
	11	15	16	57.988	1.118	18	39	58.030		26	18	18	19.535	1.026	15	39	06.195
	12	15	20	54.543	1.110	18	36	02.121		27	18	22	16.090	1.028	15	35	10.285
	13	15	24	51.098	-1.106	18	32	06.211		28	18	26	12.645	-1.031	15	31	14.376
	14	15	28	47.654	1.103	18	28	10.302		29	18	30	09.201	1.036	15	27	18.466
	15	15	32	44.209	1.104	18	24	14.393		30	18	34	05.756	1.038	15	23	22.557
	16	15	36	40.764	1.107	18	20	18.483	July	1	18	38	02.311	1.038	15	19	26.647
	17	15	40	37.320	-1.111	18	16	22.574		2	18	41	58.867	-1.035	15	15	30.738

N.B.-Apparent Sidereal Time = Mean Sidereal Time + Equation of Equinoxes for the instant

SIDEREAL TIME, 2020

Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinoxes at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)			Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinoxes at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)		
		h	m	s	s	h	m	s			h	m	s	s	h	m	s
July	1	18	38	02.311	-1.038	15	19	26.647	Aug.	16	21	39	23.858	-0.979	22	16	56.516
	2	18	41	58.867	1.035	15	15	30.738		17	21	43	20.414	0.974	22	13	00.607
	3	18	45	55.422	1.028	15	11	34.829		18	21	47	16.969	0.971	22	09	04.697
	4	18	49	51.978	1.019	15	07	38.919		19	21	51	13.524	0.970	22	05	08.788
	5	18	53	48.533	1.009	15	03	43.010		20	21	55	10.080	0.974	22	01	12.878
	6	18	57	45.088	1.001	14	59	47.100		21	21	59	06.635	0.980	21	57	16.969
	7	19	01	41.644	-0.995	14	55	51.191		22	22	03	03.191	-0.988	21	53	21.059
	8	19	05	38.199	0.991	14	51	55.281		23	22	06	59.746	0.996	21	49	25.150
	9	19	09	34.754	0.991	14	47	59.372		24	22	10	56.301	1.001	21	45	29.240
	10	19	13	31.310	0.994	14	44	03.462		25	22	14	52.857	1.003	21	41	33.331
	11	19	17	27.865	0.998	14	40	07.553		26	22	18	49.412	1.001	21	37	37.422
	12	19	21	24.420	1.002	14	36	11.643		27	22	22	45.967	0.997	21	33	41.512
	13	19	25	20.976	-1.006	14	32	15.734		28	22	26	42.523	-0.992	21	29	45.603
	14	19	29	17.531	1.009	14	28	19.824		29	22	30	39.078	0.988	21	25	49.693
	15	19	33	14.087	1.011	14	24	23.915		30	22	34	35.634	0.984	21	21	53.784
	16	19	37	10.642	1.009	14	20	28.005		31	22	38	32.189	0.984	21	17	57.874
	17	19	41	07.197	1.006	14	16	32.096	Sept.	1	22	42	28.744	0.986	21	14	01.965
	18	19	45	03.753	1.000	14	12	36.186		2	22	46	25.300	0.991	21	10	06.055
	19	19	48	60.308	-0.992	14	08	40.277		3	22	50	21.855	-0.998	21	06	10.146
	20	19	52	56.863	0.984	14	04	44.367		4	22	54	18.410	1.007	21	02	14.236
	21	19	56	53.419	0.977	14	00	48.458		5	22	58	14.966	1.015	20	58	18.327
	22	20	00	49.974	0.973	23	55	14.253		6	23	02	11.521	1.024	20	54	22.417
	23	20	04	46.530	0.972	23	51	18.344		7	23	06	08.076	1.030	20	50	26.508
	24	20	08	43.085	0.974	23	47	22.434		8	23	10	04.632	1.035	20	46	30.598
	25	20	12	39.640	-0.979	23	43	26.525		9	23	14	01.187	-1.037	20	42	34.689
	26	20	16	36.196	0.985	23	39	30.615		10	23	17	57.743	1.036	20	38	38.780
	27	20	20	32.751	0.990	23	35	34.706		11	23	21	54.298	1.034	20	34	42.870
	28	20	24	29.306	0.992	23	31	38.796		12	23	25	50.853	1.031	20	30	46.961
	29	20	28	25.862	0.991	23	27	42.887		13	23	29	47.409	1.027	20	26	51.051
	30	20	32	22.417	0.987	23	23	46.977		14	23	33	43.964	1.024	20	22	55.142
	31	20	36	18.972	-0.980	23	19	51.068		15	23	37	40.519	-1.024	20	18	59.232
Aug.	1	20	40	15.528	0.972	23	15	55.158		16	23	41	37.075	1.028	20	15	03.323
	2	20	44	12.083	0.966	23	11	59.249		17	23	45	33.630	1.035	20	11	07.413
	3	20	48	08.639	0.961	23	08	03.339		18	23	49	30.186	1.044	20	07	11.504
	4	20	52	05.194	0.959	23	04	07.430		19	23	53	26.741	1.053	20	03	15.594
	5	20	56	01.749	0.959	23	00	11.520		20	23	57	23.296	1.060	19	59	19.685
	6	20	59	58.305	-0.963	22	56	15.611		21	0	01	19.852	-1.064	23	54	44.457
	7	21	03	54.860	0.969	22	52	19.702		22	0	05	16.407	1.064	23	50	48.548
	8	21	07	51.415	0.975	22	48	23.792		23	0	09	12.962	1.061	23	46	52.638
	9	21	11	47.971	0.982	22	44	27.883		24	0	13	09.518	1.057	23	42	56.729
	10	21	15	44.526	0.987	22	40	31.973		25	0	17	06.073	1.053	23	39	00.819
	11	21	19	41.082	0.991	22	36	36.064		26	0	21	02.628	1.050	23	35	04.910
	12	21	23	37.637	-0.993	22	32	40.154		27	0	24	59.184	-1.049	23	31	09.000
	13	21	27	34.192	0.993	22	28	44.245		28	0	28	55.739	1.052	23	27	13.091
	14	21	31	30.748	0.990	22	24	48.335		29	0	32	52.295	1.057	23	23	17.181
	15	21	35	27.303	0.985	22	20	52.426		30	0	36	48.850	1.064	23	19	21.272
	16	21	39	23.858	-0.979	22	16	56.516	Oct.	1	0	40	45.405	-1.073	23	15	25.362

N.B.-Apparent Sidereal Time = Mean Sidereal Time + Equation of Equinoxes for the instant

SIDEREAL TIME, 2020

Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinoxes at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)			Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinoxes at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)		
		h	m	s	s	h	m	s			h	m	s	s	h	m	s
Oct.	1	0	40	45.405	-1.073	23	15	25.362	Nov.	16	3	42	06.952	-1.132	20	14	33.527
	2	0	44	41.961	1.082	23	11	29.453		17	3	46	03.508	1.124	20	10	37.617
	3	0	48	38.516	1.090	23	07	33.543		18	3	49	60.063	1.114	20	06	41.708
	4	0	52	35.071	1.097	23	03	37.634		19	3	53	56.618	1.105	20	02	45.798
	5	0	56	31.627	1.103	22	59	41.725		20	3	57	53.174	1.098	19	58	49.889
	6	1	00	28.182	1.105	22	55	45.815		21	4	01	49.729	1.094	19	54	53.979
	7	1	04	24.738	-1.106	22	51	49.906		22	4	05	46.284	-1.093	19	50	58.070
	8	1	08	21.293	1.104	22	47	53.996		23	4	09	42.840	1.094	19	47	02.161
	9	1	12	17.848	1.101	22	43	58.087		24	4	13	39.395	1.098	19	43	06.251
	10	1	16	14.404	1.097	22	40	02.177		25	4	17	35.951	1.103	19	39	10.342
	11	1	20	10.959	1.094	22	36	06.268		26	4	21	32.506	1.107	19	35	14.432
	12	1	24	07.514	1.093	22	32	10.358		27	4	25	29.061	1.111	19	31	18.523
	13	1	28	04.070	-1.095	22	28	14.449		28	4	29	25.617	-1.112	19	27	22.613
	14	1	31	60.625	1.099	22	24	18.539		29	4	33	22.172	1.112	19	23	26.704
	15	1	35	57.180	1.107	22	20	22.630		30	4	37	18.727	1.108	19	19	30.794
	16	1	39	53.736	1.116	22	16	26.720	Dec.	1	4	41	15.283	1.103	19	15	34.885
	17	1	43	50.291	1.123	22	12	30.811		2	4	45	11.838	1.096	19	11	38.975
	18	1	47	46.847	1.128	22	08	34.901		3	4	49	08.394	1.088	19	07	43.066
	19	1	51	43.402	-1.128	22	04	38.992		4	4	53	04.949	-1.080	19	03	47.156
	20	1	55	39.957	1.124	22	00	43.083		5	4	57	01.504	1.073	18	59	51.247
	21	1	59	36.513	1.118	21	56	47.173		6	5	00	58.060	1.069	18	55	55.337
	22	2	03	33.068	1.111	21	52	51.264		7	5	04	54.615	1.067	18	51	59.428
	23	2	07	29.623	1.106	21	48	55.354		8	5	08	51.170	1.068	18	48	03.518
	24	2	11	26.179	1.103	21	44	59.445		9	5	12	47.726	1.072	18	44	07.609
	25	2	15	22.734	-1.103	21	41	03.535		10	5	16	44.281	-1.075	18	40	11.699
	26	2	19	19.290	1.106	21	37	07.626		11	5	20	40.836	1.078	18	36	15.790
	27	2	23	15.845	1.111	21	33	11.716		12	5	24	37.392	1.078	18	32	19.881
	28	2	27	12.400	1.118	21	29	15.807		13	5	28	33.947	1.073	18	28	23.971
	29	2	31	08.956	1.125	21	25	19.897		14	5	32	30.503	1.064	18	24	28.062
	30	2	35	05.511	1.132	21	21	23.988		15	5	36	27.058	1.053	18	20	32.152
	31	2	39	02.066	-1.138	21	17	28.078		16	5	40	23.613	-1.041	18	16	36.243
Nov.	1	2	42	58.622	1.141	21	13	32.169		17	5	44	20.169	1.031	18	12	40.333
	2	2	46	55.177	1.143	21	09	36.259		18	5	48	16.724	1.023	18	08	44.424
	3	2	50	51.732	1.141	21	05	40.350		19	5	52	13.279	1.019	18	04	48.514
	4	2	54	48.288	1.138	21	01	44.440		20	5	56	09.835	1.019	18	00	52.605
	5	2	58	44.843	1.133	20	57	48.531		21	6	00	06.390	1.020	17	56	56.695
	6	3	02	41.399	-1.127	20	53	52.622		22	6	04	02.946	-1.024	17	53	00.786
	7	3	06	37.954	1.122	20	49	56.712		23	6	07	59.501	1.027	17	49	04.876
	8	3	10	34.509	1.118	20	46	00.803		24	6	11	56.056	1.030	17	45	08.967
	9	3	14	31.065	1.117	20	42	04.893		25	6	15	52.612	1.031	17	41	13.057
	10	3	18	27.620	1.118	20	38	08.984		26	6	19	49.167	1.030	17	37	17.148
	11	3	22	24.175	1.122	20	34	13.074		27	6	23	45.722	1.027	17	33	21.239
	12	3	26	20.731	-1.128	20	30	17.165		28	6	27	42.278	-1.021	17	29	25.329
	13	3	30	17.286	1.134	20	26	21.255		29	6	31	38.833	1.014	17	25	29.420
	14	3	34	13.842	1.138	20	22	25.346		30	6	35	35.388	1.005	17	21	33.510
	15	3	38	10.397	1.137	20	18	29.436		31	6	39	31.944	0.996	17	17	37.601
	16	3	42	06.952	-1.132	20	14	33.527	Dec	32	6	43	28.499	-0.988	17	13	41.691

N.B.-Apparent Sidereal Time = Mean Sidereal Time + Equation of Equinoxes for the instant

SUN, 2020
MEAN LONGITUDE AND ANOMALY

Date		Horizontal Parallax	Mean Longitude			Mean Anomaly	Date		Horizontal Parallax	Mean Longitude			Mean Anomaly
		"	°	′	"	°			"	°	′	"	°
Jan	**1**	8.94	280	07	39.318	356.846	Jul	**9**	8.65	107	24	02.112	184.110
	11	8.94	289	59	02.623	6.702		**19**	8.65	117	15	25.417	193.966
	21	8.94	299	50	25.928	16.558		**29**	8.66	127	06	48.722	203.822
	31	8.93	309	41	49.233	26.414	Aug	**8**	8.67	136	58	12.027	213.678
Feb	**10**	8.91	319	33	12.538	36.270		**18**	8.69	146	49	35.332	223.534
	20	8.9	329	24	35.843	46.126		**28**	8.71	156	40	58.637	233.390
Mar	**1**	8.88	339	15	59.148	55.982	Sep	**7**	8.73	166	32	21.942	243.246
	11	8.85	349	07	22.453	65.838		**17**	8.75	176	23	45.247	253.102
	21	8.83	358	58	45.758	75.694		**27**	8.77	186	15	08.552	262.958
	31	8.8	8	50	09.063	85.550	Oct	**7**	8.8	196	06	31.857	272.814
Apr	**10**	8.78	18	41	32.368	95.406		**17**	8.82	205	57	55.162	282.670
	20	8.75	28	32	55.673	105.262		**27**	8.85	215	49	18.467	292.526
	30	8.73	38	24	18.978	115.118	Nov	**6**	8.87	225	40	41.772	302.382
May	**10**	8.71	48	15	42.283	124.974		**16**	8.89	235	32	05.077	312.238
	20	8.69	58	07	05.588	134.830		**26**	8.91	245	23	28.382	322.094
	30	8.67	67	58	28.892	144.686	Dec	**6**	8.93	255	14	51.687	331.950
Jun	**9**	8.66	77	49	52.197	154.542		**16**	8.94	265	06	14.992	341.806
	19	8.65	87	41	15.502	164.398		**26**	8.94	274	57	38.297	351.662
	29	8.65	97	32	38.807	174.254		**36**	8.94	284	49	01.602	1.518
Jul	**9**	8.65	107	24	02.112	184.110		**46**	8.94	294	40	24.907	11.374

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FOR 0^h TERRESTRIAL TIME

Date		Geometric Longitude* (Mean Equinox of date) °	'	"	Latitude (Ecliptic of date) "	Apparent Longitude (True equinox of date) °	'	"	Aberration "	Prec. in Long. (J 2020.5 of date) "	Nut. in Long. "	Nut. in Obliquity "	True Obliquity (23° 26') "
Jan.	0	278	59	58.46	-0.40	278	59	21.19	20.84	-25.58	-16.47	-1.75	10.29
	1	280	01	08.58	0.47	280	00	31.28	20.84	25.44	16.49	1.70	10.34
	2	281	02	18.57	0.50	281	01	41.23	20.84	25.30	16.54	1.67	10.37
	3	282	03	28.40	0.50	282	02	51.00	20.84	25.16	16.60	1.65	10.39
	4	283	04	38.04	0.47	283	04	00.59	20.84	25.02	16.66	1.65	10.39
	5	284	05	47.38	0.43	284	05	09.89	20.84	24.88	16.69	1.66	10.38
	6	285	06	56.46	-0.36	285	06	18.97	20.84	-24.74	-16.69	-1.68	10.36
	7	286	08	05.21	0.25	286	07	27.77	20.84	24.60	16.65	1.70	10.33
	8	287	09	13.67	-0.11	287	08	36.31	20.84	24.46	16.56	1.72	10.31
	9	288	10	21.80	+0.00	288	09	44.57	20.84	24.33	16.43	1.72	10.30
	10	289	11	29.61	0.14	289	10	52.54	20.84	24.19	16.28	1.71	10.32
	11	290	12	37.13	0.29	290	12	00.22	20.84	24.05	16.12	1.67	10.35
	12	291	13	44.44	+0.43	291	13	07.64	20.84	-23.91	-16.00	-1.61	10.41
	13	292	14	51.50	0.58	292	14	14.78	20.84	23.77	15.92	1.54	10.49
	14	293	15	58.41	0.65	293	15	21.71	20.84	23.63	15.91	1.46	10.56
	15	294	17	05.16	0.72	294	16	28.42	20.84	23.49	15.95	1.40	10.62
	16	295	18	11.80	0.76	295	17	34.98	20.84	23.35	16.02	1.36	10.66
	17	296	19	18.25	0.76	296	18	41.36	20.84	23.21	16.10	1.34	10.67
	18	297	20	24.57	+0.72	297	19	47.64	20.83	-23.08	-16.15	-1.35	10.67
	19	298	21	30.67	0.65	298	20	53.74	20.83	22.94	16.15	1.37	10.65
	20	299	22	36.50	0.54	299	21	59.62	20.83	22.80	16.10	1.39	10.63
	21	300	23	41.97	0.43	300	23	05.17	20.83	22.66	16.02	1.40	10.61
	22	301	24	47.05	0.32	301	24	10.37	20.83	22.52	15.90	1.40	10.62
	23	302	25	51.65	0.18	302	25	15.10	20.82	22.38	15.78	1.37	10.64
	24	303	26	55.63	+0.04	303	26	19.18	20.82	-22.24	-15.67	-1.33	10.68
	25	304	27	58.91	-0.07	304	27	22.54	20.82	22.10	15.60	1.27	10.74
	26	305	29	01.41	0.18	305	28	25.07	20.82	21.96	15.57	1.21	10.80
	27	306	30	03.04	0.29	306	29	26.70	20.82	21.83	15.57	1.14	10.87
	28	307	31	03.75	0.36	307	30	27.36	20.81	21.69	15.62	1.08	10.92
	29	308	32	03.41	0.40	308	31	26.94	20.81	21.55	15.70	1.03	10.97
	30	309	33	01.96	-0.40	309	32	25.40	20.81	-21.41	-15.79	-1.00	11.01
	31	310	33	59.32	0.40	310	33	22.68	20.81	21.27	15.88	0.98	11.02
Feb.	1	311	34	55.49	0.36	311	34	18.77	20.80	21.13	15.96	0.97	11.03
	2	312	35	50.36	0.29	312	35	13.60	20.80	20.99	16.01	0.98	11.02
	3	313	36	43.91	0.18	313	36	07.13	20.80	20.85	16.03	0.99	11.01
	4	314	37	36.15	-0.07	314	36	59.40	20.79	20.72	16.00	1.00	11.00
	5	315	38	26.94	+0.04	315	37	50.27	20.79	-20.58	-15.93	-1.00	10.99
	6	316	39	16.41	0.18	316	38	39.84	20.79	20.44	15.83	0.99	11.00
	7	317	40	04.46	0.32	317	39	28.01	20.79	20.30	15.71	0.95	11.04
	8	318	40	51.12	0.47	318	40	14.77	20.78	20.16	15.61	0.90	11.09
	9	319	41	36.45	0.58	319	41	00.17	20.78	20.02	15.55	0.82	11.17
	10	320	42	20.51	0.68	320	41	44.23	20.77	19.88	15.55	0.73	11.25
	11	321	43	03.30	+0.76	321	42	26.96	20.77	-19.74	-15.62	-0.66	11.33
	12	322	43	44.92	0.79	322	43	08.47	20.77	19.60	15.72	0.61	11.38
	13	323	44	25.39	0.79	323	43	48.83	20.76	19.47	15.84	0.58	11.41
	14	324	45	04.76	0.76	324	44	28.10	20.76	19.33	15.95	0.58	11.41
	15	325	45	42.98	+0.72	325	45	06.26	20.75	-19.19	-16.00	-0.59	11.39

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -17' 10".958 and subtract precession from J 2020.5.

SUN, 2020

FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Semi Diameter		Ephemeris Transit		
		h	m	s	°	'	"		'	"	h	m	s
Jan.	0	18	39	07.80	-23	07	53.76	0.983 3175	16	15.93	12	02	50.60
	1	18	43	33.11	23	03	31.98	0.983 2931	16	15.95	12	03	19.22
	2	18	47	58.12	22	58	42.54	0.983 2733	16	15.97	12	03	47.51
	3	18	52	22.77	22	53	25.57	0.983 2583	16	15.98	12	04	15.44
	4	18	56	47.06	22	47	41.24	0.983 2484	16	15.99	12	04	42.98
	5	19	01	10.94	22	41	29.72	0.983 2439	16	16.00	12	05	10.11
	6	19	05	34.40	-22	34	51.20	0.983 2449	16	16.00	12	05	36.78
	7	19	09	57.39	22	27	45.88	0.983 2516	16	15.99	12	06	02.99
	8	19	14	19.91	22	20	13.99	0.983 2645	16	15.98	12	06	28.70
	9	19	18	41.91	22	12	15.76	0.983 2835	16	15.96	12	06	53.88
	10	19	23	03.39	22	03	51.43	0.983 3090	16	15.93	12	07	18.53
	11	19	27	24.32	21	55	01.25	0.983 3410	16	15.90	12	07	42.62
	12	19	31	44.68	-21	45	45.48	0.983 3796	16	15.86	12	08	06.12
	13	19	36	04.45	21	36	04.37	0.983 4248	16	15.82	12	08	29.03
	14	19	40	23.61	21	25	58.19	0.983 4763	16	15.77	12	08	51.33
	15	19	44	42.14	21	15	27.20	0.983 5341	16	15.71	12	09	13.00
	16	19	49	00.04	21	04	31.68	0.983 5977	16	15.65	12	09	34.02
	17	19	53	17.29	20	53	11.91	0.983 6669	16	15.58	12	09	54.39
	18	19	57	33.87	-20	41	28.20	0.983 7412	16	15.51	12	10	14.07
	19	20	01	49.76	20	29	20.87	0.983 8203	16	15.43	12	10	33.06
	20	20	06	04.96	20	16	50.25	0.983 9040	16	15.34	12	10	51.34
	21	20	10	19.44	20	03	56.68	0.983 9918	16	15.26	12	11	08.89
	22	20	14	33.18	19	50	40.53	0.984 0835	16	15.17	12	11	25.70
	23	20	18	46.18	19	37	02.14	0.984 1789	16	15.07	12	11	41.75
	24	20	22	58.41	-19	23	01.89	0.984 2780	16	14.97	12	11	57.03
	25	20	27	09.87	19	08	40.16	0.984 3805	16	14.87	12	12	11.53
	26	20	31	20.52	18	53	57.31	0.984 4865	16	14.77	12	12	25.22
	27	20	35	30.38	18	38	53.73	0.984 5960	16	14.66	12	12	38.11
	28	20	39	39.42	18	23	29.81	0.984 7091	16	14.55	12	12	50.18
	29	20	43	47.63	18	07	45.93	0.984 8258	16	14.43	12	13	01.43
	30	20	47	55.03	-17	51	42.50	0.984 9462	16	14.31	12	13	11.85
	31	20	52	01.59	17	35	19.92	0.985 0706	16	14.19	12	13	21.44
Feb.	1	20	56	07.31	17	18	38.59	0.985 1991	16	14.06	12	13	30.19
	2	21	00	12.21	17	01	38.92	0.985 3317	16	13.93	12	13	38.11
	3	21	04	16.27	16	44	21.33	0.985 4688	16	13.80	12	13	45.19
	4	21	08	19.50	16	26	46.24	0.985 6106	16	13.66	12	13	51.44
	5	21	12	21.90	-16	08	54.07	0.985 7572	16	13.51	12	13	56.86
	6	21	16	23.48	15	50	45.24	0.985 9088	16	13.36	12	14	01.46
	7	21	20	24.24	15	32	20.16	0.986 0658	16	13.21	12	14	05.24
	8	21	24	24.19	15	13	39.26	0.986 2282	16	13.05	12	14	08.22
	9	21	28	23.33	14	54	42.95	0.986 3963	16	12.88	12	14	10.40
	10	21	32	21.68	14	35	31.62	0.986 5700	16	12.71	12	14	11.80
	11	21	36	19.25	-14	16	05.67	0.986 7493	16	12.53	12	14	12.42
	12	21	40	16.05	13	56	25.48	0.986 9340	16	12.35	12	14	12.29
	13	21	44	12.10	13	36	31.42	0.987 1239	16	12.16	12	14	11.42
	14	21	48	07.42	13	16	23.88	0.987 3187	16	11.97	12	14	09.82
	15	21	52	02.02	-12	56	03.27	0.987 5179	16	11.77	12	14	07.50

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FOR 0^h TERRESTRIAL TIME

Date		Geometric Longitude* (Mean Equinox of date)			Latitude (Ecliptic of date)	Apparent Longitude (True equinox of date)			Aberra-tion	Prec. in Long. (J 2020.5 of date)	Nut. in Long.	Nut. in Obliquity	True Obliquity (23° 26')
		°	'	"	"	°	'	"	"	"	"	"	"
Feb.	15	325	45	42.98	+0.72	325	45	06.26	20.75	-19.19	-16.00	-0.59	11.39
	16	326	46	20.09	0.61	326	45	43.38	20.75	19.05	16.01	0.61	11.37
	17	327	46	56.05	0.50	327	46	19.38	20.75	18.91	15.97	0.63	11.35
	18	328	47	30.83	0.40	328	46	54.23	20.74	18.77	15.90	0.63	11.35
	19	329	48	04.34	0.25	329	47	27.82	20.74	18.63	15.83	0.61	11.37
	20	330	48	36.56	0.14	330	48	00.11	20.73	18.49	15.76	0.57	11.40
	21	331	49	07.37	+0.00	331	48	30.96	20.73	-18.35	-15.73	-0.52	11.45
	22	332	49	36.74	-0.11	332	49	00.34	20.72	18.22	15.73	0.46	11.51
	23	333	50	04.61	0.18	333	49	28.16	20.72	18.08	15.77	0.40	11.57
	24	334	50	30.85	0.25	334	49	54.34	20.71	17.94	15.85	0.34	11.63
	25	335	50	55.44	0.32	335	50	18.82	20.71	17.80	15.96	0.29	11.68
	26	336	51	18.25	0.32	336	50	41.50	20.70	17.66	16.10	0.26	11.71
	27	337	51	39.30	-0.32	337	51	02.41	20.70	-17.52	-16.23	-0.24	11.73
	28	338	51	58.43	0.29	338	51	21.42	20.69	17.38	16.36	0.24	11.73
	29	339	52	15.66	0.22	339	51	38.56	20.69	17.24	16.46	0.25	11.72
Mar.	1	340	52	30.88	0.14	340	51	53.71	20.68	17.10	16.53	0.27	11.70
	2	341	52	44.11	-0.04	341	52	06.92	20.68	16.96	16.55	0.29	11.67
	3	342	52	55.25	+0.07	342	52	18.08	20.67	16.83	16.54	0.30	11.66
	4	343	53	04.27	+0.22	343	52	27.16	20.67	-16.69	-16.49	-0.30	11.65
	5	344	53	11.22	0.32	344	52	34.18	20.66	16.55	16.42	0.29	11.67
	6	345	53	16.04	0.47	345	52	39.07	20.66	16.41	16.35	0.25	11.70
	7	346	53	18.73	0.58	346	52	41.81	20.65	16.27	16.31	0.19	11.76
	8	347	53	19.38	0.68	347	52	42.46	20.65	16.13	16.32	0.12	11.83
	9	348	53	17.97	0.76	348	52	40.98	20.64	15.99	16.39	-0.05	11.90
	10	349	53	14.59	+0.79	349	52	37.49	20.64	-15.85	-16.51	+0.00	11.95
	11	350	53	09.30	0.83	350	52	32.05	20.63	15.71	16.67	0.03	11.98
	12	351	53	02.24	0.79	351	52	24.85	20.63	15.58	16.81	+0.02	11.97
	13	352	52	53.37	0.76	352	52	15.89	20.62	15.44	16.91	-0.01	11.94
	14	353	52	42.83	0.65	353	52	05.30	20.62	15.30	16.96	0.04	11.90
	15	354	52	30.58	0.54	354	51	53.06	20.61	15.16	16.95	0.08	11.87
	16	355	52	16.67	+0.43	355	51	39.20	20.60	-15.02	-16.90	-0.10	11.85
	17	356	52	01.05	0.29	356	51	23.65	20.60	14.88	16.85	0.10	11.84
	18	357	51	43.75	0.18	357	51	06.41	20.59	14.74	16.80	0.08	11.86
	19	358	51	24.71	+0.07	358	50	47.40	20.59	14.60	16.77	0.05	11.89
	20	359	51	03.91	-0.04	359	50	26.59	20.58	14.46	16.78	-0.01	11.93
	21	0	50	41.27	0.14	0	50	03.91	20.57	14.33	16.83	+0.04	11.98
	22	1	50	16.81	-0.22	1	49	39.36	20.57	-14.19	-16.92	+0.08	12.02
	23	2	49	50.39	0.25	2	49	12.83	20.56	14.05	17.05	0.12	12.05
	24	3	49	22.05	0.29	3	48	44.35	20.56	13.91	17.19	0.14	12.07
	25	4	48	51.67	0.29	4	48	13.82	20.55	13.77	17.34	0.14	12.07
	26	5	48	19.22	0.25	5	47	41.24	20.55	13.63	17.48	0.13	12.06
	27	6	47	44.67	0.22	6	47	06.58	20.54	13.49	17.60	0.10	12.03
	28	7	47	07.92	0.11	7	46	29.75	20.53	-13.35	-17.69	+0.07	12.00
	29	8	46	29.01	-0.04	8	45	50.80	20.53	13.21	17.73	+0.03	11.96
	30	9	45	47.79	+0.11	9	45	09.58	20.52	13.08	17.74	-0.00	11.92
	31	10	45	04.30	0.22	10	44	26.12	20.52	12.94	17.71	0.03	11.89
Apr.	1	11	44	18.48	+0.36	11	43	40.37	20.51	-12.80	-17.65	-0.04	11.88

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -17' 10".958 and subtract precession from J 2020.5.

SUN, 2020
FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Semi Diameter		Ephemeris Transit		
		h	m	s	°	'	"		'	"	h	m	s
Feb.	15	21	52	02.02	-12	56	03.27	0.987 5179	16	11.77	12	14	07.50
	16	21	55	55.91	12	35	29.98	0.987 7212	16	11.57	12	14	04.47
	17	21	59	49.10	12	14	44.44	0.987 9281	16	11.37	12	14	00.76
	18	22	03	41.60	11	53	47.06	0.988 1383	16	11.16	12	13	56.35
	19	22	07	33.43	11	32	38.26	0.988 3515	16	10.96	12	13	51.28
	20	22	11	24.58	11	11	18.48	0.988 5673	16	10.74	12	13	45.54
	21	22	15	15.08	-10	49	48.13	0.988 7855	16	10.53	12	13	39.15
	22	22	19	04.93	10	28	07.63	0.989 0060	16	10.31	12	13	32.12
	23	22	22	54.15	10	06	17.42	0.989 2286	16	10.09	12	13	24.47
	24	22	26	42.74	9	44	17.90	0.989 4531	16	09.87	12	13	16.20
	25	22	30	30.72	9	22	09.50	0.989 6795	16	09.65	12	13	07.32
	26	22	34	18.10	8	59	52.64	0.989 9078	16	09.43	12	12	57.86
	27	22	38	04.90	-8	37	27.72	0.990 1381	16	09.20	12	12	47.83
	28	22	41	51.14	8	14	55.17	0.990 3702	16	08.98	12	12	37.23
	29	22	45	36.82	7	52	15.40	0.990 6044	16	08.75	12	12	26.09
Mar.	1	22	49	21.97	7	29	28.82	0.990 8407	16	08.52	12	12	14.43
	2	22	53	06.60	7	06	35.85	0.991 0793	16	08.28	12	12	02.25
	3	22	56	50.74	6	43	36.89	0.991 3202	16	08.05	12	11	49.58
	4	23	00	34.39	-6	20	32.35	0.991 5637	16	07.81	12	11	36.44
	5	23	04	17.57	5	57	22.64	0.991 8101	16	07.57	12	11	22.84
	6	23	08	00.32	5	34	08.15	0.992 0594	16	07.33	12	11	08.81
	7	23	11	42.63	5	10	49.29	0.992 3120	16	07.08	12	10	54.36
	8	23	15	24.55	4	47	26.44	0.992 5679	16	06.83	12	10	39.53
	9	23	19	06.08	4	23	59.95	0.992 8275	16	06.58	12	10	24.33
	10	23	22	47.25	-4	00	30.20	0.993 0908	16	06.32	12	10	08.79
	11	23	26	28.10	3	36	57.51	0.993 3576	16	06.06	12	09	52.94
	12	23	30	08.64	3	13	22.21	0.993 6279	16	05.80	12	09	36.79
	13	23	33	48.91	2	49	44.65	0.993 9014	16	05.53	12	09	20.38
	14	23	37	28.93	2	26	05.16	0.994 1776	16	05.26	12	09	03.73
	15	23	41	08.72	2	02	24.10	0.994 4563	16	04.99	12	08	46.86
	16	23	44	48.30	-1	38	41.83	0.994 7371	16	04.72	12	08	29.79
	17	23	48	27.70	1	14	58.72	0.995 0194	16	04.45	12	08	12.54
	18	23	52	06.92	0	51	15.15	0.995 3029	16	04.17	12	07	55.13
	19	23	55	45.99	-0	27	31.49	0.995 5873	16	03.90	12	07	37.58
	20	23	59	24.93	+0	03	48.12	0.995 8723	16	03.62	12	07	19.90
	21	0	03	03.75	0	19	54.59	0.996 1576	16	03.35	12	07	02.12
	22	0	06	42.46	+0	43	36.26	0.996 4430	16	03.07	12	06	44.25
	23	0	10	21.10	1	07	16.52	0.996 7282	16	02.79	12	06	26.31
	24	0	13	59.68	1	30	55.00	0.997 0131	16	02.52	12	06	08.32
	25	0	17	38.21	1	54	31.32	0.997 2977	16	02.25	12	05	50.29
	26	0	21	16.71	2	18	05.11	0.997 5817	16	01.97	12	05	32.24
	27	0	24	55.20	2	41	36.01	0.997 8652	16	01.70	12	05	14.19
	28	0	28	33.70	+3	05	03.63	0.998 1482	16	01.43	12	04	56.16
	29	0	32	12.23	3	28	27.61	0.998 4306	16	01.15	12	04	38.16
	30	0	35	50.81	3	51	47.58	0.998 7127	16	00.88	12	04	20.21
	31	0	39	29.44	4	15	03.18	0.998 9944	16	00.61	12	04	02.32
Apr.	1	0	43	08.15	+4	38	14.02	0.999 2759	16	00.34	12	03	44.53

SUN, 2020

FOR 0^h TERRESTRIAL TIME

Date		Geometric Longitude* (Mean Equinox of date)			Latitude (Ecliptic of date)	Apparent Longitude (True equinox of date)			Aberra- tion	Prec. in Long. (J 2020.5 of date)	Nut. in Long.	Nut. in Obliquity	True Obliquity (23° 26')
		°	'	"	"	°	'	"	"	"	"	"	"
Apr.	1	11	44	18.48	+0.36	11	43	40.37	20.51	-12.80	-17.65	-0.04	11.88
	2	12	43	30.36	0.47	12	42	52.31	20.50	12.66	17.59	-0.03	11.89
	3	13	42	39.83	0.58	13	42	01.84	20.50	12.52	17.54	0.00	11.92
	4	14	41	47.01	0.68	14	41	09.02	20.49	12.38	17.53	+0.05	11.97
	5	15	40	51.89	0.76	15	40	13.87	20.49	12.24	17.58	0.10	12.02
	6	16	39	54.46	0.83	16	39	16.34	20.48	12.10	17.68	0.15	12.06
	7	17	38	54.83	+0.83	17	38	16.58	20.48	-11.96	-17.82	+0.17	12.08
	8	18	37	53.09	0.79	18	37	14.70	20.47	11.83	17.96	0.16	12.07
	9	19	36	49.33	0.76	19	36	10.84	20.46	11.69	18.08	0.12	12.03
	10	20	35	43.57	0.68	20	35	05.03	20.46	11.55	18.13	0.07	11.98
	11	21	34	35.99	0.58	21	33	57.46	20.45	11.41	18.13	+0.01	11.92
	12	22	33	26.63	0.43	22	32	48.16	20.45	11.27	18.07	-0.03	11.87
	13	23	32	15.48	+0.32	23	31	37.09	20.44	-11.13	-17.99	-0.06	11.85
	14	24	31	02.64	0.18	24	30	24.34	20.43	10.99	17.91	0.06	11.84
	15	25	29	48.09	+0.07	25	29	09.85	20.43	10.85	17.85	0.05	11.85
	16	26	28	31.81	-0.04	26	27	53.60	20.42	10.71	17.83	-0.02	11.88
	17	27	27	13.89	0.14	27	26	35.66	20.42	10.58	17.85	+0.01	11.91
	18	28	25	54.21	0.22	28	25	15.92	20.41	10.44	17.92	0.04	11.94
	19	29	24	32.83	-0.29	29	23	54.46	20.41	-10.30	-18.01	+0.06	11.96
	20	30	23	09.71	0.29	30	22	31.22	20.40	10.16	18.13	0.07	11.97
	21	31	21	44.76	0.29	31	21	06.16	20.39	10.02	18.26	0.06	11.96
	22	32	20	18.01	0.29	32	19	39.29	20.39	9.88	18.38	0.04	11.94
	23	33	18	49.43	0.22	33	18	10.62	20.38	9.74	18.48	+0.01	11.90
	24	34	17	18.96	0.14	34	16	40.08	20.38	9.60	18.55	-0.04	11.85
	25	35	15	46.57	-0.04	35	15	07.67	20.37	-9.46	-18.57	-0.09	11.80
	26	36	14	12.23	+0.07	36	13	33.35	20.37	9.33	18.56	0.14	11.75
	27	37	12	35.91	0.18	37	11	57.08	20.36	9.19	18.51	0.18	11.71
	28	38	10	57.54	0.32	38	10	18.80	20.36	9.05	18.43	0.20	11.68
	29	39	09	17.15	0.43	39	08	38.51	20.35	8.91	18.34	0.21	11.68
	30	40	07	34.69	0.54	40	06	56.12	20.35	8.77	18.26	0.19	11.69
May	1	41	05	50.12	+0.65	41	05	11.62	20.34	-8.63	-18.21	-0.16	11.72
	2	42	04	03.52	0.72	42	03	25.02	20.34	8.49	18.21	0.12	11.76
	3	43	02	14.85	0.79	43	01	36.30	20.33	8.35	18.26	0.09	11.80
	4	44	00	24.16	0.79	43	59	45.53	20.33	8.21	18.35	0.06	11.82
	5	44	58	31.55	0.79	44	57	52.81	20.32	8.08	18.46	0.07	11.81
	6	45	56	37.02	0.76	45	55	58.19	20.32	7.94	18.56	0.10	11.78
	7	46	54	40.71	+0.65	46	54	01.84	20.31	-7.80	-18.61	-0.15	11.72
	8	47	52	42.72	0.58	47	52	03.86	20.31	7.66	18.60	0.22	11.66
	9	48	50	43.12	0.43	48	50	04.34	20.30	7.52	18.52	0.28	11.60
	10	49	48	42.04	0.29	49	48	03.38	20.30	7.38	18.40	0.32	11.56
	11	50	46	39.54	0.18	50	46	01.02	20.29	7.24	18.27	0.33	11.54
	12	51	44	35.69	+0.04	51	43	57.29	20.29	7.10	18.16	0.33	11.54
	13	52	42	30.54	-0.11	52	41	52.22	20.28	-6.96	-18.08	-0.31	11.56
	14	53	40	24.14	0.22	53	39	45.86	20.28	6.82	18.04	0.28	11.59
	15	54	38	16.52	0.29	54	37	38.24	20.27	6.69	18.05	0.25	11.62
	16	55	36	07.65	0.36	55	35	29.33	20.27	6.55	18.10	0.22	11.64
	17	56	33	57.62	-0.40	56	33	19.22	20.27	-6.41	-18.17	-0.21	11.66

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -17' 10".958 and subtract precession from J 2020.5.

SUN, 2020

FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Semi Diameter		Ephemeris Transit		
		h	m	s	°	'	"		'	"	h	m	s
Apr.	1	0	43	08.15	+4	38	14.02	0.999 2759	16	00.34	12	03	44.53
	2	0	46	46.96	5	01	19.75	0.999 5574	16	00.07	12	03	26.83
	3	0	50	25.88	5	24	20.00	0.999 8391	15	59.80	12	03	09.26
	4	0	54	04.93	5	47	14.41	1.000 1212	15	59.53	12	02	51.84
	5	0	57	44.13	6	10	02.64	1.000 4040	15	59.26	12	02	34.57
	6	1	01	23.50	6	32	44.34	1.000 6877	15	58.99	12	02	17.49
	7	1	05	03.07	+6	55	19.19	1.000 9725	15	58.71	12	02	00.62
	8	1	08	42.85	7	17	46.89	1.001 2585	15	58.44	12	01	43.98
	9	1	12	22.88	7	40	07.14	1.001 5456	15	58.16	12	01	27.59
	10	1	16	03.17	8	02	19.66	1.001 8338	15	57.89	12	01	11.47
	11	1	19	43.75	8	24	24.13	1.002 1227	15	57.61	12	00	55.65
	12	1	23	24.64	8	46	20.25	1.002 4121	15	57.34	12	00	40.15
	13	1	27	05.86	+9	08	07.69	1.002 7016	15	57.06	12	00	24.97
	14	1	30	47.42	9	29	46.13	1.002 9907	15	56.78	12	00	10.15
	15	1	34	29.33	9	51	15.22	1.003 2791	15	56.51	11	59	55.70
	16	1	38	11.62	10	12	34.62	1.003 5665	15	56.23	11	59	41.62
	17	1	41	54.29	10	33	44.00	1.003 8525	15	55.96	11	59	27.94
	18	1	45	37.36	10	54	43.00	1.004 1367	15	55.69	11	59	14.66
	19	1	49	20.84	+11	15	31.28	1.004 4189	15	55.42	11	59	01.81
	20	1	53	04.75	11	36	08.50	1.004 6989	15	55.16	11	58	49.38
	21	1	56	49.08	11	56	34.32	1.004 9764	15	54.89	11	58	37.39
	22	2	00	33.87	12	16	48.39	1.005 2512	15	54.63	11	58	25.86
	23	2	04	19.11	12	36	50.37	1.005 5232	15	54.37	11	58	14.78
	24	2	08	04.81	12	56	39.92	1.005 7923	15	54.12	11	58	04.17
	25	2	11	50.99	+13	16	16.69	1.006 0584	15	53.87	11	57	54.03
	26	2	15	37.66	13	35	40.34	1.006 3214	15	53.62	11	57	44.38
	27	2	19	24.81	13	54	50.54	1.006 5814	15	53.37	11	57	35.22
	28	2	23	12.45	14	13	46.92	1.006 8385	15	53.13	11	57	26.56
	29	2	27	00.60	14	32	29.16	1.007 0928	15	52.89	11	57	18.39
	30	2	30	49.25	14	50	56.92	1.007 3443	15	52.65	11	57	10.74
May	1	2	34	38.41	+15	09	09.85	1.007 5934	15	52.41	11	57	03.60
	2	2	38	28.08	15	27	07.62	1.007 8402	15	52.18	11	56	56.98
	3	2	42	18.28	15	44	49.91	1.008 0850	15	51.95	11	56	50.89
	4	2	46	09.01	16	02	16.41	1.008 3281	15	51.72	11	56	45.33
	5	2	50	00.27	16	19	26.81	1.008 5697	15	51.49	11	56	40.32
	6	2	53	52.09	16	36	20.84	1.008 8101	15	51.26	11	56	35.86
	7	2	57	44.46	+16	52	58.23	1.009 0494	15	51.04	11	56	31.96
	8	3	01	37.40	17	09	18.72	1.009 2875	15	50.81	11	56	28.63
	9	3	05	30.92	17	25	22.04	1.009 5245	15	50.59	11	56	25.88
	10	3	09	25.02	17	41	07.93	1.009 7600	15	50.37	11	56	23.71
	11	3	13	19.71	17	56	36.11	1.009 9939	15	50.15	11	56	22.12
	12	3	17	14.98	18	11	46.29	1.010 2258	15	49.93	11	56	21.12
	13	3	21	10.84	+18	26	38.20	1.010 4554	15	49.72	11	56	20.71
	14	3	25	07.28	18	41	11.54	1.010 6823	15	49.50	11	56	20.89
	15	3	29	04.30	18	55	26.03	1.010 9062	15	49.29	11	56	21.65
	16	3	33	01.91	19	09	21.39	1.011 1267	15	49.08	11	56	22.99
	17	3	37	00.09	+19	22	57.34	1.011 3437	15	48.88	11	56	24.91

SUN, 2020
FOR 0^h TERRESTRIAL TIME

Date		Geometric Longitude* (Mean Equinox of date)			Latitude (Ecliptic of date)	Apparent Longitude (True equinox of date)			Aberra- tion	Prec. in Long. (J 2020.5 of date)	Nut. in Long.	Nut. in Obliquity	True Obliquity (23° 26')
		°	'	"	"	°	'	"	"	"	"	"	"
May	17	56	33	57.62	-0.40	56	33	19.22	20.27	-6.41	-18.17	-0.21	11.66
	18	57	31	46.34	0.40	57	31	07.86	20.26	6.27	18.26	0.21	11.65
	19	58	29	33.90	0.36	58	28	55.34	20.26	6.13	18.35	0.23	11.64
	20	59	27	20.19	0.32	59	26	41.57	20.25	5.99	18.42	0.26	11.60
	21	60	25	05.30	0.25	60	24	26.64	20.25	5.85	18.46	0.30	11.56
	22	61	22	49.11	0.14	61	22	10.45	20.25	5.71	18.46	0.35	11.51
	23	62	20	31.69	-0.04	62	19	53.08	20.24	-5.57	-18.41	-0.40	11.46
	24	63	18	12.96	+0.07	63	17	34.44	20.24	5.44	18.33	0.44	11.42
	25	64	15	52.88	0.22	64	15	14.47	20.23	5.30	18.22	0.46	11.39
	26	65	13	31.45	0.32	65	12	53.17	20.23	5.16	18.09	0.47	11.39
	27	66	11	08.66	0.43	66	10	30.50	20.23	5.02	17.97	0.45	11.40
	28	67	08	44.42	0.54	67	08	06.36	20.22	4.88	17.88	0.42	11.43
	29	68	06	18.79	+0.61	68	05	40.78	20.22	-4.74	-17.83	-0.37	11.47
	30	69	03	51.76	0.68	69	03	13.75	20.22	4.60	17.84	0.33	11.52
	31	70	01	23.27	0.72	70	00	45.22	20.21	4.46	17.88	0.30	11.55
June	1	70	58	53.44	0.72	70	58	15.31	20.21	4.32	17.96	0.29	11.56
	2	71	56	22.27	0.65	71	55	44.08	20.21	4.19	18.03	0.30	11.54
	3	72	53	49.81	0.58	72	53	11.58	20.21	4.05	18.07	0.34	11.50
	4	73	51	16.18	+0.50	73	50	37.97	20.20	-3.91	-18.05	-0.39	11.45
	5	74	48	41.48	0.36	74	48	03.35	20.20	3.77	17.97	0.44	11.40
	6	75	46	05.75	0.22	75	45	27.76	20.20	3.63	17.84	0.48	11.36
	7	76	43	29.17	+0.07	76	42	51.34	20.19	3.49	17.68	0.50	11.34
	8	77	40	51.76	-0.07	77	40	14.09	20.19	3.35	17.52	0.49	11.34
	9	78	38	13.70	0.18	78	37	36.16	20.19	3.21	17.39	0.46	11.37
	10	79	35	34.99	-0.29	79	34	57.54	20.19	-3.07	-17.31	-0.42	11.41
	11	80	32	55.76	0.40	80	32	18.35	20.19	2.93	17.27	0.38	11.45
	12	81	30	16.00	0.47	81	29	38.58	20.18	2.80	17.28	0.34	11.49
	13	82	27	35.77	0.50	82	26	58.31	20.18	2.66	17.32	0.31	11.52
	14	83	24	55.12	0.54	83	24	17.60	20.18	2.52	17.39	0.29	11.54
	15	84	22	14.09	0.50	84	21	36.50	20.18	2.38	17.45	0.29	11.54
	16	85	19	32.68	-0.47	85	18	55.04	20.17	-2.24	-17.51	-0.30	11.52
	17	86	16	50.89	0.43	86	16	13.22	20.17	2.10	17.54	0.33	11.50
	18	87	14	08.74	0.32	87	13	31.08	20.17	1.96	17.53	0.36	11.46
	19	88	11	26.18	0.22	88	10	48.58	20.17	1.82	17.48	0.39	11.43
	20	89	08	43.26	-0.11	89	08	05.75	20.17	1.68	17.39	0.42	11.40
	21	90	05	59.98	+0.00	90	05	22.60	20.17	1.55	17.27	0.44	11.38
	22	91	03	16.22	+0.14	91	02	38.98	20.17	-1.41	-17.12	-0.43	11.38
	23	92	00	32.06	0.25	91	59	54.96	20.16	1.27	16.98	0.41	11.41
	24	92	57	47.39	0.36	92	57	10.40	20.16	1.13	16.86	0.36	11.45
	25	93	55	02.22	0.47	93	54	25.31	20.16	0.99	16.79	0.30	11.51
	26	94	52	16.53	0.54	94	51	39.64	20.16	0.85	16.77	0.24	11.57
	27	95	49	30.27	0.58	95	48	53.35	20.16	0.71	16.80	0.19	11.62
	28	96	46	43.51	+0.58	96	46	06.53	20.16	-0.57	-16.86	-0.16	11.65
	29	97	43	56.18	0.54	97	43	19.13	20.16	0.43	16.93	0.15	11.66
	30	98	41	08.35	0.47	98	40	31.26	20.16	0.30	16.98	0.16	11.64
July	1	99	38	20.12	0.40	99	37	43.03	20.16	0.16	16.98	0.20	11.61
	2	100	35	31.48	+0.25	100	34	54.44	20.16	-0.02	-16.92	-0.23	11.57

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -17' 10".958 and subtract precession from J 2020.5.

SUN, 2020
FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Semi Diameter		Ephemeris Transit		
		h	m	s	°	'	"		'	"	h	m	s
May	17	3	37	00.09	+19	22	57.34	1.011 3437	15	48.88	11	56	24.91
	18	3	40	58.85	19	36	13.60	1.011 5568	15	48.68	11	56	27.39
	19	3	44	58.17	19	49	09.90	1.011 7657	15	48.49	11	56	30.44
	20	3	48	58.04	20	01	45.98	1.011 9702	15	48.29	11	56	34.04
	21	3	52	58.47	20	14	01.56	1.012 1702	15	48.11	11	56	38.19
	22	3	56	59.44	20	25	56.40	1.012 3654	15	47.92	11	56	42.86
	23	4	01	00.93	+20	37	30.24	1.012 5557	15	47.75	11	56	48.06
	24	4	05	02.94	20	48	42.82	1.012 7411	15	47.57	11	56	53.76
	25	4	09	05.45	20	59	33.92	1.012 9215	15	47.40	11	56	59.94
	26	4	13	08.45	21	10	03.29	1.013 0969	15	47.24	11	57	06.61
	27	4	17	11.91	21	20	10.68	1.013 2674	15	47.08	11	57	13.73
	28	4	21	15.81	21	29	55.88	1.013 4332	15	46.92	11	57	21.30
	29	4	25	20.15	+21	39	18.66	1.013 5943	15	46.77	11	57	29.29
	30	4	29	24.91	21	48	18.81	1.013 7512	15	46.63	11	57	37.70
	31	4	33	30.07	21	56	56.11	1.013 9040	15	46.48	11	57	46.50
June	1	4	37	35.61	22	05	10.40	1.014 0530	15	46.35	11	57	55.68
	2	4	41	41.52	22	13	01.50	1.014 1986	15	46.21	11	58	05.22
	3	4	45	47.79	22	20	29.25	1.014 3410	15	46.08	11	58	15.11
	4	4	49	54.42	+22	27	33.52	1.014 4806	15	45.95	11	58	25.35
	5	4	54	01.37	22	34	14.19	1.014 6173	15	45.82	11	58	35.90
	6	4	58	08.65	22	40	31.15	1.014 7514	15	45.69	11	58	46.77
	7	5	02	16.23	22	46	24.27	1.014 8826	15	45.57	11	58	57.93
	8	5	06	24.09	22	51	53.45	1.015 0111	15	45.45	11	59	09.37
	9	5	10	32.23	22	56	58.57	1.015 1364	15	45.34	11	59	21.08
	10	5	14	40.62	+23	01	39.52	1.015 2584	15	45.22	11	59	33.02
	11	5	18	49.24	23	05	56.21	1.015 3768	15	45.11	11	59	45.20
	12	5	22	58.07	23	09	48.51	1.015 4914	15	45.01	11	59	57.57
	13	5	27	07.09	23	13	16.37	1.015 6018	15	44.90	12	00	10.13
	14	5	31	16.28	23	16	19.68	1.015 7078	15	44.80	12	00	22.85
	15	5	35	25.62	23	18	58.38	1.015 8090	15	44.71	12	00	35.71
	16	5	39	35.09	+23	21	12.42	1.015 9054	15	44.62	12	00	48.68
	17	5	43	44.66	23	23	01.74	1.015 9965	15	44.54	12	01	01.73
	18	5	47	54.30	23	24	26.31	1.016 0822	15	44.46	12	01	14.85
	19	5	52	04.00	23	25	26.10	1.016 1623	15	44.38	12	01	28.01
	20	5	56	13.72	23	26	01.10	1.016 2366	15	44.31	12	01	41.17
	21	6	00	23.44	23	26	11.29	1.016 3050	15	44.25	12	01	54.32
	22	6	04	33.13	+23	25	56.68	1.016 3673	15	44.19	12	02	07.42
	23	6	08	42.75	23	25	17.28	1.016 4236	15	44.14	12	02	20.44
	24	6	12	52.29	23	24	13.12	1.016 4739	15	44.09	12	02	33.36
	25	6	17	01.71	23	22	44.21	1.016 5182	15	44.05	12	02	46.15
	26	6	21	10.97	23	20	50.60	1.016 5568	15	44.01	12	02	58.78
	27	6	25	20.07	23	18	32.32	1.016 5898	15	43.98	12	03	11.23
	28	6	29	28.96	+23	15	49.45	1.016 6177	15	43.96	12	03	23.46
	29	6	33	37.63	23	12	42.04	1.016 6407	15	43.94	12	03	35.47
	30	6	37	46.07	23	09	10.20	1.016 6592	15	43.92	12	03	47.22
July	1	6	41	54.24	23	05	14.02	1.016 6734	15	43.91	12	03	58.70
	2	6	46	02.14	+23	00	53.64	1.016 6838	15	43.90	12	04	09.89

SUN, 2020

FOR 0^h TERRESTRIAL TIME

Date		Geometric Longitude* (Mean Equinox of date)			Latitude (Ecliptic of date)	Apparent Longitude (True equinox of date)			Aberration	Prec. in Long. (J 2020.5 of date)	Nut. in Long.	Nut. in Obliquity	True Obliquity (23° 26')
		°	'	"	"	°	'	"	"	"	"	"	"
July	1	99	38	20.12	+0.40	99	37	43.03	20.16	-0.16	-16.98	-0.20	11.61
	2	100	35	31.48	0.25	100	34	54.44	20.16	-0.02	16.92	0.23	11.57
	3	101	32	42.56	+0.14	101	32	05.64	20.16	+0.12	16.81	0.26	11.55
	4	102	29	53.43	-0.00	102	29	16.66	20.16	0.26	16.66	0.27	11.54
	5	103	27	04.18	0.14	103	26	27.56	20.16	0.40	16.50	0.25	11.55
	6	104	24	14.95	0.29	104	23	38.47	20.16	0.54	16.36	0.22	11.58
	7	105	21	25.79	-0.40	105	20	49.42	20.16	+0.68	-16.26	-0.16	11.64
	8	106	18	36.83	0.50	106	18	00.50	20.16	0.82	16.21	0.10	11.70
	9	107	15	48.13	0.58	107	15	11.81	20.16	0.96	16.21	-0.04	11.76
	10	108	12	59.76	0.65	108	12	23.40	20.16	1.09	16.25	+0.01	11.81
	11	109	10	11.78	0.65	109	09	35.35	20.16	1.23	16.31	0.05	11.84
	12	110	07	24.27	0.65	110	06	47.77	20.16	1.37	16.39	0.07	11.87
	13	111	04	37.23	-0.61	111	04	00.66	20.16	+1.51	-16.46	+0.08	11.87
	14	112	01	50.71	0.58	112	01	14.09	20.16	1.65	16.51	0.07	11.86
	15	112	59	04.74	0.47	112	58	28.09	20.16	1.79	16.53	0.06	11.85
	16	113	56	19.37	0.40	113	55	42.74	20.16	1.93	16.51	0.04	11.83
	17	114	53	34.57	0.29	114	52	58.01	20.16	2.07	16.44	0.02	11.81
	18	115	50	50.35	0.14	115	50	13.88	20.17	2.21	16.34	0.02	11.80
	19	116	48	06.71	-0.04	116	47	30.37	20.17	+2.34	-16.22	+0.03	11.81
	20	117	45	23.65	+0.11	117	44	47.44	20.17	2.48	16.09	0.06	11.84
	21	118	42	41.14	0.22	118	42	05.04	20.17	2.62	15.98	0.12	11.90
	22	119	39	59.11	0.32	119	39	23.08	20.17	2.76	15.91	0.19	11.97
	23	120	37	17.56	0.40	120	36	41.54	20.17	2.90	15.89	0.26	12.04
	24	121	34	36.43	0.43	121	34	00.37	20.18	3.04	15.93	0.33	12.11
	25	122	31	55.70	+0.43	122	31	19.56	20.18	+3.18	-16.01	+0.39	12.16
	26	123	29	15.34	0.43	123	28	39.11	20.18	3.32	16.10	0.41	12.19
	27	124	26	35.37	0.36	124	25	59.05	20.18	3.46	16.18	0.41	12.19
	28	125	23	55.82	0.29	125	23	19.46	20.18	3.60	16.22	0.40	12.17
	29	126	21	16.65	0.18	126	20	40.31	20.19	3.73	16.20	0.38	12.15
	30	127	18	37.97	+0.07	127	18	01.69	20.19	3.87	16.13	0.36	12.13
	31	128	15	59.82	-0.07	128	15	23.65	20.19	+4.01	-16.02	+0.35	12.12
Aug.	1	129	13	22.27	0.22	129	12	46.22	20.19	4.15	15.90	0.37	12.14
	2	130	10	45.42	0.32	130	10	09.48	20.20	4.29	15.79	0.41	12.18
	3	131	08	09.39	0.47	131	07	33.53	20.20	4.43	15.71	0.47	12.23
	4	132	05	34.20	0.58	132	04	58.37	20.20	4.57	15.67	0.54	12.30
	5	133	02	59.96	0.65	133	02	24.11	20.20	4.71	15.69	0.61	12.37
	6	134	00	26.80	-0.72	133	59	50.89	20.21	+4.85	-15.75	+0.67	12.43
	7	134	57	54.72	0.72	134	57	18.72	20.21	4.98	15.84	0.72	12.48
	8	135	55	23.85	0.76	135	54	47.74	20.21	5.12	15.94	0.76	12.51
	9	136	52	54.24	0.72	136	52	18.01	20.22	5.26	16.05	0.77	12.53
	10	137	50	25.94	0.68	137	49	49.62	20.22	5.40	16.14	0.78	12.53
	11	138	47	58.98	0.61	138	47	22.60	20.22	5.54	16.21	0.77	12.52
	12	139	45	33.43	-0.50	139	44	57.01	20.23	+5.68	-16.24	+0.76	12.51
	13	140	43	09.32	0.40	140	42	32.90	20.23	5.82	16.23	0.74	12.49
	14	141	40	46.68	0.29	141	40	10.31	20.23	5.96	16.18	0.74	12.49
	15	142	38	25.48	0.14	142	37	49.19	20.24	6.10	16.10	0.74	12.49
	16	143	36	05.75	-0.04	143	35	29.54	20.24	+6.24	-16.01	+0.77	12.52

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -17' 10".958 and subtract precession from J 2020.5.

SUN, 2020

FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Semi Diameter		Ephemeris Transit		
		h	m	s	°	'	"		'	"	h	m	s
July	1	6	41	54.24	+23	05	14.02	1.016 6734	15	43.91	12	03	58.70
	2	6	46	02.14	23	00	53.64	1.016 6838	15	43.90	12	04	09.89
	3	6	50	09.74	22	56	09.17	1.016 6906	15	43.89	12	04	20.77
	4	6	54	17.02	22	51	00.75	1.016 6939	15	43.89	12	04	31.33
	5	6	58	23.98	22	45	28.53	1.016 6938	15	43.89	12	04	41.56
	6	7	02	30.59	22	39	32.64	1.016 6904	15	43.89	12	04	51.42
	7	7	06	36.84	+22	33	13.22	1.016 6837	15	43.90	12	05	00.92
	8	7	10	42.71	22	26	30.42	1.016 6734	15	43.91	12	05	10.04
	9	7	14	48.19	22	19	24.38	1.016 6594	15	43.92	12	05	18.76
	10	7	18	53.26	22	11	55.27	1.016 6416	15	43.94	12	05	27.07
	11	7	22	57.91	22	04	03.24	1.016 6198	15	43.96	12	05	34.96
	12	7	27	02.13	21	55	48.47	1.016 5936	15	43.98	12	05	42.40
	13	7	31	05.90	+21	47	11.14	1.016 5630	15	44.01	12	05	49.39
	14	7	35	09.21	21	38	11.44	1.016 5275	15	44.04	12	05	55.91
	15	7	39	12.05	21	28	49.57	1.016 4872	15	44.08	12	06	01.95
	16	7	43	14.40	21	19	05.75	1.016 4416	15	44.12	12	06	07.50
	17	7	47	16.25	21	09	00.17	1.016 3906	15	44.17	12	06	12.53
	18	7	51	17.59	20	58	33.08	1.016 3340	15	44.22	12	06	17.04
	19	7	55	18.40	+20	47	44.71	1.016 2717	15	44.28	12	06	21.01
	20	7	59	18.66	20	36	35.29	1.016 2033	15	44.34	12	06	24.44
	21	8	03	18.37	20	25	05.08	1.016 1290	15	44.41	12	06	27.30
	22	8	07	17.50	20	13	14.33	1.016 0485	15	44.49	12	06	29.58
	23	8	11	16.05	20	01	03.29	1.015 9621	15	44.57	12	06	31.27
	24	8	15	14.00	19	48	32.22	1.015 8697	15	44.65	12	06	32.36
	25	8	19	11.34	+19	35	41.38	1.015 7717	15	44.74	12	06	32.84
	26	8	23	08.06	19	22	31.05	1.015 6683	15	44.84	12	06	32.71
	27	8	27	04.17	19	09	01.49	1.015 5599	15	44.94	12	06	31.95
	28	8	30	59.66	18	55	12.98	1.015 4469	15	45.05	12	06	30.57
	29	8	34	54.52	18	41	05.83	1.015 3296	15	45.16	12	06	28.56
	30	8	38	48.76	18	26	40.33	1.015 2084	15	45.27	12	06	25.92
	31	8	42	42.38	+18	11	56.76	1.015 0836	15	45.38	12	06	22.66
Aug.	1	8	46	35.38	17	56	55.43	1.014 9555	15	45.50	12	06	18.79
	2	8	50	27.75	17	41	36.62	1.014 8243	15	45.63	12	06	14.29
	3	8	54	19.52	17	26	00.63	1.014 6901	15	45.75	12	06	09.19
	4	8	58	10.67	17	10	07.72	1.014 5531	15	45.88	12	06	03.49
	5	9	02	01.22	16	53	58.18	1.014 4132	15	46.01	12	05	57.18
	6	9	05	51.18	+16	37	32.30	1.014 2704	15	46.14	12	05	50.29
	7	9	09	40.55	16	20	50.34	1.014 1247	15	46.28	12	05	42.82
	8	9	13	29.33	16	03	52.59	1.013 9758	15	46.42	12	05	34.77
	9	9	17	17.55	15	46	39.34	1.013 8237	15	46.56	12	05	26.15
	10	9	21	05.21	15	29	10.87	1.013 6683	15	46.70	12	05	16.98
	11	9	24	52.31	15	11	27.49	1.013 5092	15	46.85	12	05	07.25
	12	9	28	38.86	+14	53	29.48	1.013 3465	15	47.01	12	04	56.98
	13	9	32	24.88	14	35	17.15	1.013 1797	15	47.16	12	04	46.18
	14	9	36	10.37	14	16	50.82	1.013 0089	15	47.32	12	04	34.85
	15	9	39	55.34	13	58	10.78	1.012 8337	15	47.48	12	04	23.00
	16	9	43	39.80	+13	39	17.37	1.012 6540	15	47.65	12	04	10.64

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FOR 0^h TERRESTRIAL TIME

Date		Geometric Longitude* (Mean Equinox of date)			Latitude (Ecliptic of date)	Apparent Longitude (True equinox of date)			Aberration	Prec. in Long. (J 2020.5 of date)	Nut. in Long.	Nut. in Obliquity	True Obliquity (23° 26')
		°	'	"	"	°	'	"	"	"	"	"	"
Aug.	16	143	36	05.75	-0.04	143	35	29.54	20.24	+6.24	-16.01	+0.77	12.52
	17	144	33	47.50	+0.11	144	33	11.38	20.24	6.37	15.92	0.82	12.57
	18	145	31	30.68	0.18	145	30	54.61	20.25	6.51	15.87	0.89	12.64
	19	146	29	15.29	0.29	146	28	39.22	20.25	6.65	15.87	0.97	12.71
	20	147	27	01.21	0.32	147	26	25.08	20.25	6.79	15.92	1.05	12.79
	21	148	24	48.48	0.32	148	24	12.24	20.26	6.93	16.03	1.11	12.85
	22	149	22	36.97	+0.32	149	22	00.59	20.26	+7.07	-16.16	+1.14	12.88
	23	150	20	26.70	0.29	150	19	50.20	20.27	7.21	16.28	1.15	12.89
	24	151	18	17.59	0.22	151	17	40.99	20.27	7.35	16.37	1.13	12.87
	25	152	16	09.68	+0.11	152	15	33.05	20.28	7.49	16.40	1.11	12.84
	26	153	14	02.94	-0.00	153	13	26.33	20.28	7.62	16.37	1.08	12.82
	27	154	11	57.38	0.14	154	11	20.83	20.29	7.76	16.31	1.07	12.80
	28	155	09	53.07	-0.29	155	09	16.60	20.29	+7.90	-16.23	+1.08	12.81
	29	156	07	50.09	0.40	156	07	13.69	20.29	8.04	16.15	1.11	12.84
	30	157	05	48.43	0.50	157	05	12.08	20.30	8.18	16.10	1.16	12.89
	31	158	03	48.23	0.61	158	03	11.88	20.30	8.32	16.09	1.22	12.95
Sept.	1	159	01	49.50	0.72	159	01	13.12	20.31	8.46	16.12	1.28	13.01
	2	159	59	52.34	0.76	159	59	15.86	20.31	8.60	16.21	1.34	13.07
	3	160	57	56.83	-0.79	160	57	20.23	20.32	+8.74	-16.32	+1.39	13.11
	4	161	56	03.07	0.79	161	55	26.33	20.32	8.88	16.46	1.42	13.15
	5	162	54	11.08	0.79	162	53	34.19	20.33	9.01	16.60	1.44	13.16
	6	163	52	20.91	0.76	163	51	43.88	20.33	9.15	16.74	1.44	13.16
	7	164	50	32.66	0.68	164	49	55.52	20.34	9.29	16.84	1.42	13.14
	8	165	48	46.39	0.58	165	48	09.18	20.34	9.43	16.92	1.40	13.12
	9	166	47	02.10	-0.47	166	46	24.85	20.35	+9.57	-16.95	+1.38	13.09
	10	167	45	19.87	0.36	167	44	42.61	20.35	9.71	16.95	1.36	13.07
	11	168	43	39.72	0.25	168	43	02.50	20.36	9.85	16.91	1.35	13.06
	12	169	42	01.64	-0.11	169	41	24.47	20.36	9.99	16.85	1.36	13.07
	13	170	40	25.68	+0.00	170	39	48.56	20.37	10.13	16.79	1.39	13.10
	14	171	38	51.83	0.11	171	38	14.75	20.37	10.26	16.75	1.44	13.15
	15	172	37	20.03	+0.18	172	36	42.95	20.38	+10.40	-16.75	+1.50	13.21
	16	173	35	50.35	0.25	173	35	13.20	20.39	10.54	16.81	1.57	13.27
	17	174	34	22.62	0.29	174	33	45.36	20.39	10.68	16.92	1.62	13.33
	18	175	32	56.84	0.25	175	32	19.43	20.40	10.82	17.07	1.66	13.36
	19	176	31	32.94	0.22	176	30	55.37	20.40	10.96	17.22	1.66	13.36
	20	177	30	10.84	0.14	177	29	33.14	20.41	11.10	17.34	1.63	13.34
	21	178	28	50.49	+0.07	178	28	12.72	20.41	+11.24	-17.40	+1.59	13.29
	22	179	27	31.84	-0.07	179	26	54.06	20.42	11.38	17.40	1.55	13.25
	23	180	26	14.86	0.18	180	25	37.13	20.42	11.52	17.36	1.52	13.22
	24	181	24	59.56	0.32	181	24	21.89	20.43	11.65	17.28	1.51	13.20
	25	182	23	45.91	0.47	182	23	08.30	20.44	11.79	17.21	1.52	13.21
	26	183	22	33.94	0.58	183	21	56.38	20.44	11.93	17.17	1.55	13.24
	27	184	21	23.70	-0.68	184	20	46.14	20.45	+12.07	-17.16	+1.59	13.28
	28	185	20	15.27	0.76	185	19	37.67	20.45	12.21	17.19	1.64	13.33
	29	186	19	08.65	0.83	186	18	30.96	20.46	12.35	17.28	1.68	13.37
	30	187	18	03.87	0.86	187	17	26.05	20.47	12.49	17.40	1.71	13.40
Oct.	1	188	17	01.05	-0.86	188	16	23.09	20.47	+12.63	-17.54	+1.73	13.42

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -17' 10".958 and subtract precession from J 2020.5.

SUN, 2020
FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension h	m	s	Apparent Declination °	'	"	True Distance from the Earth	Semi Diameter '	"	Ephemeris Transit h	m	s
Aug.	16	9	43	39.80	+13	39	17.37	1.012 6540	15	47.65	12	04	10.64
	17	9	47	23.75	13	20	10.90	1.012 4695	15	47.83	12	03	57.78
	18	9	51	07.20	13	00	51.71	1.012 2801	15	48.00	12	03	44.42
	19	9	54	50.15	12	41	20.12	1.012 0857	15	48.19	12	03	30.57
	20	9	58	32.61	12	21	36.47	1.011 8863	15	48.37	12	03	16.24
	21	10	02	14.59	12	01	41.08	1.011 6818	15	48.56	12	03	01.44
	22	10	05	56.10	+11	41	34.29	1.011 4726	15	48.76	12	02	46.17
	23	10	09	37.14	11	21	16.43	1.011 2587	15	48.96	12	02	30.44
	24	10	13	17.74	11	00	47.84	1.011 0407	15	49.17	12	02	14.27
	25	10	16	57.90	10	40	08.85	1.010 8188	15	49.37	12	01	57.66
	26	10	20	37.63	10	19	19.80	1.010 5936	15	49.59	12	01	40.64
	27	10	24	16.96	9	58	21.03	1.010 3653	15	49.80	12	01	23.21
	28	10	27	55.90	+9	37	12.87	1.010 1343	15	50.02	12	01	05.40
	29	10	31	34.46	9	15	55.65	1.009 9011	15	50.24	12	00	47.23
	30	10	35	12.67	8	54	29.69	1.009 6658	15	50.46	12	00	28.70
	31	10	38	50.53	8	32	55.30	1.009 4288	15	50.68	12	00	09.85
Sept.	1	10	42	28.07	8	11	12.79	1.009 1901	15	50.91	11	59	50.70
	2	10	46	05.31	7	49	22.45	1.008 9500	15	51.13	11	59	31.25
	3	10	49	42.27	+7	27	24.59	1.008 7086	15	51.36	11	59	11.54
	4	10	53	18.98	7	05	19.51	1.008 4657	15	51.59	11	58	51.58
	5	10	56	55.45	6	43	07.51	1.008 2216	15	51.82	11	58	31.40
	6	11	00	31.70	6	20	48.87	1.007 9760	15	52.05	11	58	11.01
	7	11	04	07.77	5	58	23.91	1.007 7290	15	52.28	11	57	50.44
	8	11	07	43.66	5	35	52.94	1.007 4804	15	52.52	11	57	29.71
	9	11	11	19.40	+5	13	16.25	1.007 2301	15	52.76	11	57	08.83
	10	11	14	55.01	4	50	34.18	1.006 9780	15	52.99	11	56	47.83
	11	11	18	30.50	4	27	47.02	1.006 7239	15	53.24	11	56	26.72
	12	11	22	05.91	4	04	55.11	1.006 4676	15	53.48	11	56	05.53
	13	11	25	41.24	3	41	58.78	1.006 2089	15	53.72	11	55	44.28
	14	11	29	16.51	3	18	58.36	1.005 9477	15	53.97	11	55	22.97
	15	11	32	51.73	+2	55	54.20	1.005 6836	15	54.22	11	55	01.64
	16	11	36	26.94	2	32	46.64	1.005 4166	15	54.47	11	54	40.29
	17	11	40	02.13	2	09	36.04	1.005 1465	15	54.73	11	54	18.94
	18	11	43	37.33	1	46	22.75	1.004 8732	15	54.99	11	53	57.61
	19	11	47	12.55	1	23	07.12	1.004 5968	15	55.25	11	53	36.30
	20	11	50	47.81	0	59	49.52	1.004 3175	15	55.52	11	53	15.05
	21	11	54	23.13	+0	36	30.29	1.004 0356	15	55.79	11	52	53.86
	22	11	57	58.53	0	13	09.81	1.003 7515	15	56.06	11	52	32.75
	23	12	01	34.02	0	10	11.55	1.003 4654	15	56.33	11	52	11.74
	24	12	05	09.62	0	33	33.45	1.003 1780	15	56.60	11	51	50.85
	25	12	08	45.35	+0	56	55.50	1.002 8895	15	56.88	11	51	30.10
	26	12	12	21.24	-1	20	17.38	1.002 6003	15	57.16	11	51	09.51
	27	12	15	57.30	-1	43	38.72	1.002 3109	15	57.43	11	50	49.11
	28	12	19	33.55	2	06	59.20	1.002 0214	15	57.71	11	50	28.92
	29	12	23	10.02	2	30	18.47	1.001 7322	15	57.99	11	50	08.96
	30	12	26	46.73	2	53	36.22	1.001 4436	15	58.26	11	49	49.26
Oct.	1	12	30	23.71	-3	16	52.10	1.001 1555	15	58.54	11	49	29.83

SUN, 2020

FOR 0^h TERRESTRIAL TIME

Date		Geometric Longitude* (Mean Equinox of date)			Latitude (Ecliptic of date)	Apparent Longitude (True equinox of date)			Aberra-tion	Prec. in Long. (J 2020.5 of date)	Nut. in Long.	Nut. in Obliquity	True Obliquity (23° 26')
		°	'	"	"	°	'	"	"	"	"	"	"
Oct.	1	188	17	01.05	-0.86	188	16	23.09	20.47	+12.63	-17.54	+1.73	13.42
	2	189	16	00.19	0.83	189	15	22.07	20.48	12.77	17.69	1.74	13.42
	3	190	15	01.36	0.79	190	14	23.10	20.48	12.91	17.83	1.72	13.41
	4	191	14	04.64	0.72	191	13	26.26	20.49	13.04	17.94	1.69	13.38
	5	192	13	10.05	0.65	192	12	31.57	20.50	13.18	18.03	1.65	13.34
	6	193	12	17.65	0.54	193	11	39.12	20.50	13.32	18.07	1.61	13.29
	7	194	11	27.44	-0.40	194	10	48.90	20.51	+13.46	-18.08	+1.57	13.26
	8	195	10	39.54	0.29	195	10	01.02	20.51	13.60	18.05	1.55	13.23
	9	196	09	53.92	0.14	196	09	15.44	20.52	13.74	18.00	1.53	13.21
	10	197	09	10.59	-0.04	197	08	32.17	20.52	13.88	17.94	1.54	13.21
	11	198	08	29.62	+0.07	198	07	51.24	20.53	14.02	17.89	1.56	13.24
	12	199	07	50.97	0.14	199	07	12.61	20.54	14.16	17.87	1.60	13.27
	13	200	07	14.64	+0.22	200	06	36.25	20.54	+14.29	-17.90	+1.65	13.32
	14	201	06	40.60	0.25	201	06	02.12	20.55	14.43	17.98	1.69	13.36
	15	202	06	08.83	0.25	202	05	30.23	20.55	14.57	18.10	1.72	13.39
	16	203	05	39.25	0.22	203	05	00.49	20.56	14.71	18.24	1.72	13.39
	17	204	05	11.73	0.14	204	04	32.84	20.56	14.85	18.36	1.69	13.36
	18	205	04	46.25	+0.04	205	04	07.28	20.57	14.99	18.44	1.63	13.30
	19	206	04	22.67	-0.07	206	03	43.70	20.58	+15.13	-18.44	+1.57	13.23
	20	207	04	00.95	0.18	207	03	22.03	20.58	15.27	18.38	1.51	13.18
	21	208	03	41.02	0.32	208	03	02.20	20.59	15.41	18.28	1.48	13.14
	22	209	03	22.77	0.47	209	02	44.05	20.59	15.55	18.17	1.47	13.13
	23	210	03	06.28	0.61	210	02	27.64	20.60	15.68	18.09	1.48	13.14
	24	211	02	51.44	0.72	211	02	12.84	20.61	15.82	18.04	1.50	13.16
	25	212	02	38.30	-0.79	212	01	59.70	20.61	+15.96	-18.04	+1.54	13.19
	26	213	02	26.83	0.86	213	01	48.18	20.62	16.10	18.08	1.57	13.23
	27	214	02	17.09	0.90	214	01	38.35	20.62	16.24	18.16	1.59	13.25
	28	215	02	09.11	0.90	215	01	30.25	20.63	16.38	18.27	1.60	13.26
	29	216	02	02.90	0.86	216	01	23.92	20.63	16.52	18.39	1.60	13.25
	30	217	01	58.44	0.83	217	01	19.34	20.64	16.66	18.51	1.57	13.23
	31	218	01	55.84	-0.76	218	01	16.64	20.65	+16.80	-18.60	+1.54	13.19
Nov.	1	219	01	55.12	0.65	219	01	15.85	20.65	16.94	18.66	1.49	13.14
	2	220	01	56.26	0.54	220	01	16.97	20.66	17.07	18.68	1.44	13.08
	3	221	01	59.38	0.43	221	01	20.10	20.66	17.21	18.66	1.38	13.03
	4	222	02	04.44	0.29	222	01	25.21	20.67	17.35	18.61	1.34	12.99
	5	223	02	11.49	0.18	223	01	32.34	20.67	17.49	18.53	1.31	12.96
	6	224	02	20.55	-0.04	224	01	41.48	20.68	+17.63	-18.43	+1.30	12.95
	7	225	02	31.66	+0.07	225	01	52.68	20.68	17.77	18.35	1.31	12.95
	8	226	02	44.85	0.14	226	02	05.93	20.69	17.91	18.28	1.34	12.98
	9	227	03	00.06	0.22	227	02	21.16	20.69	18.05	18.26	1.37	13.01
	10	228	03	17.37	0.29	228	02	38.44	20.70	18.19	18.28	1.41	13.05
	11	229	03	36.66	0.29	229	02	57.66	20.70	18.32	18.35	1.44	13.07
	12	230	03	57.93	+0.25	230	03	18.83	20.71	+18.46	-18.45	+1.44	13.08
	13	231	04	21.15	0.22	231	03	41.94	20.71	18.60	18.54	1.42	13.05
	14	232	04	46.23	0.11	232	04	06.96	20.72	18.74	18.60	1.37	13.00
	15	233	05	13.01	+0.00	233	04	33.74	20.72	18.88	18.59	1.31	12.94
	16	234	05	41.45	-0.14	234	05	02.26	20.72	+19.02	-18.51	+1.24	12.87

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -17' 10".958 and subtract precession from J 2020.5.

SUN, 2020
FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Semi Diameter		Ephemeris Transit		
		h	m	s	°	'	"		'	"	h	m	s
Oct.	1	12	30	23.71	-3	16	52.10	1.001 1555	15	58.54	11	49	29.83
	2	12	34	00.97	3	40	05.79	1.000 8683	15	58.81	11	49	10.71
	3	12	37	38.55	4	03	16.97	1.000 5820	15	59.09	11	48	51.91
	4	12	41	16.47	4	26	25.31	1.000 2965	15	59.36	11	48	33.46
	5	12	44	54.76	4	49	30.47	1.000 0121	15	59.63	11	48	15.38
	6	12	48	33.42	5	12	32.12	0.999 7286	15	59.91	11	47	57.70
	7	12	52	12.50	-5	35	29.91	0.999 4459	16	00.18	11	47	40.43
	8	12	55	52.00	5	58	23.50	0.999 1641	16	00.45	11	47	23.59
	9	12	59	31.95	6	21	12.53	0.998 8829	16	00.72	11	47	07.22
	10	13	03	12.37	6	43	56.66	0.998 6022	16	00.99	11	46	51.32
	11	13	06	53.28	7	06	35.50	0.998 3219	16	01.26	11	46	35.91
	12	13	10	34.69	7	29	08.69	0.998 0418	16	01.53	11	46	21.03
	13	13	14	16.63	-7	51	35.84	0.997 7615	16	01.80	11	46	06.67
	14	13	17	59.10	8	13	56.55	0.997 4810	16	02.07	11	45	52.87
	15	13	21	42.13	8	36	10.41	0.997 1999	16	02.34	11	45	39.63
	16	13	25	25.73	8	58	16.98	0.996 9182	16	02.61	11	45	26.97
	17	13	29	09.91	9	20	15.97	0.996 6357	16	02.88	11	45	14.90
	18	13	32	54.68	9	42	07.10	0.996 3525	16	03.16	11	45	03.43
	19	13	36	40.08	-10	03	49.80	0.996 0688	16	03.43	11	44	52.57
	20	13	40	26.10	10	25	23.61	0.995 7848	16	03.71	11	44	42.34
	21	13	44	12.75	10	46	48.12	0.995 5010	16	03.98	11	44	32.75
	22	13	48	00.06	11	08	02.92	0.995 2175	16	04.26	11	44	23.81
	23	13	51	48.02	11	29	07.60	0.994 9350	16	04.53	11	44	15.54
	24	13	55	36.65	11	50	01.76	0.994 6538	16	04.80	11	44	07.95
	25	13	59	25.96	-12	10	45.00	0.994 3742	16	05.07	11	44	01.05
	26	14	03	15.98	12	31	16.91	0.994 0966	16	05.34	11	43	54.87
	27	14	07	06.72	12	51	37.12	0.993 8213	16	05.61	11	43	49.41
	28	14	10	58.19	13	11	45.23	0.993 5486	16	05.88	11	43	44.69
	29	14	14	50.40	13	31	40.86	0.993 2787	16	06.14	11	43	40.73
	30	14	18	43.38	13	51	23.63	0.993 0118	16	06.40	11	43	37.54
	31	14	22	37.13	-14	10	53.16	0.992 7481	16	06.65	11	43	35.13
Nov.	1	14	26	31.68	14	30	09.06	0.992 4877	16	06.91	11	43	33.51
	2	14	30	27.03	14	49	10.97	0.992 2308	16	07.16	11	43	32.70
	3	14	34	23.19	15	07	58.50	0.991 9772	16	07.41	11	43	32.71
	4	14	38	20.19	15	26	31.26	0.991 7272	16	07.65	11	43	33.55
	5	14	42	18.01	15	44	48.87	0.991 4806	16	07.89	11	43	35.23
	6	14	46	16.68	-16	02	50.94	0.991 2373	16	08.13	11	43	37.75
	7	14	50	16.21	16	20	37.06	0.990 9973	16	08.36	11	43	41.13
	8	14	54	16.58	16	38	06.86	0.990 7604	16	08.59	11	43	45.37
	9	14	58	17.82	16	55	19.91	0.990 5264	16	08.82	11	43	50.48
	10	15	02	19.92	17	12	15.82	0.990 2950	16	09.05	11	43	56.45
	11	15	06	22.89	17	28	54.18	0.990 0661	16	09.27	11	44	03.29
	12	15	10	26.72	-17	45	14.57	0.989 8394	16	09.50	11	44	11.00
	13	15	14	31.42	18	01	16.59	0.989 6146	16	09.72	11	44	19.57
	14	15	18	36.99	18	16	59.83	0.989 3915	16	09.93	11	44	29.00
	15	15	22	43.41	18	32	23.88	0.989 1700	16	10.15	11	44	39.29
	16	15	26	50.68	-18	47	28.35	0.988 9502	16	10.37	11	44	50.41

SUN, 2020

FOR 0^h TERRESTRIAL TIME

Date		Geometric Longitude* (Mean Equinox of date) °	'	"	Latitude (Ecliptic of date) "	Apparent Longitude (True equinox of date) °	'	"	Aberration "	Prec. in Long. (J 2020.5 of date) "	Nut. in Long. "	Nut. in Obliquity "	True Obliquity (23° 26') "
Nov.	16	234	05	41.45	-0.14	234	05	02.26	20.72	+19.02	-18.51	+1.24	12.87
	17	235	06	11.45	0.25	235	05	32.39	20.73	19.16	18.38	1.19	12.82
	18	236	06	42.86	0.40	236	06	03.96	20.73	19.30	18.22	1.17	12.79
	19	237	07	15.62	0.54	237	06	36.86	20.74	19.44	18.06	1.17	12.79
	20	238	07	49.67	0.65	238	07	11.03	20.74	19.58	17.95	1.19	12.81
	21	239	08	24.92	0.76	239	07	46.34	20.75	19.71	17.88	1.23	12.85
	22	240	09	01.42	-0.83	240	08	22.85	20.75	+19.85	-17.86	+1.26	12.88
	23	241	09	39.03	0.86	241	09	00.43	20.76	19.99	17.89	1.29	12.91
	24	242	10	17.83	0.86	242	09	39.17	20.76	20.13	17.95	1.31	12.93
	25	243	10	57.76	0.86	243	10	19.02	20.76	20.27	18.03	1.31	12.93
	26	244	11	38.81	0.83	244	10	59.99	20.77	20.41	18.10	1.29	12.91
	27	245	12	21.03	0.76	245	11	42.14	20.77	20.55	18.16	1.26	12.88
	28	246	13	04.40	-0.65	246	12	25.49	20.78	+20.69	-18.19	+1.22	12.83
	29	247	13	48.96	0.54	247	13	10.06	20.78	20.83	18.18	1.17	12.79
	30	248	14	34.67	0.43	248	13	55.81	20.78	20.97	18.12	1.13	12.74
Dec.	1	249	15	21.60	0.29	249	14	42.83	20.79	21.10	18.03	1.09	12.70
	2	250	16	09.73	0.14	250	15	31.07	20.79	21.24	17.92	1.06	12.67
	3	251	16	59.13	-0.00	251	16	20.60	20.79	21.38	17.78	1.05	12.66
	4	252	17	49.76	+0.11	252	17	11.36	20.80	+21.52	-17.65	+1.07	12.67
	5	253	18	41.71	0.22	253	18	03.42	20.80	21.66	17.54	1.10	12.70
	6	254	19	34.93	0.29	254	18	56.70	20.80	21.80	17.47	1.14	12.74
	7	255	20	29.48	0.36	255	19	51.28	20.80	21.94	17.45	1.19	12.79
	8	256	21	25.30	0.36	256	20	47.08	20.81	22.08	17.47	1.23	12.83
	9	257	22	22.42	0.36	257	21	44.14	20.81	22.22	17.52	1.25	12.85
	10	258	23	20.77	+0.32	258	22	42.42	20.81	+22.36	-17.58	+1.25	12.85
	11	259	24	20.32	0.25	259	23	41.93	20.81	22.49	17.63	1.22	12.82
	12	260	25	21.01	0.14	260	24	42.62	20.82	22.63	17.62	1.17	12.77
	13	261	26	22.72	+0.00	261	25	44.40	20.82	22.77	17.54	1.12	12.72
	14	262	27	25.36	-0.14	262	26	47.18	20.82	22.91	17.40	1.08	12.67
	15	263	28	28.83	0.29	263	27	50.83	20.82	23.05	17.22	1.05	12.64
	16	264	29	32.97	-0.40	264	28	55.16	20.83	+23.19	-17.02	+1.06	12.65
	17	265	30	37.74	0.54	265	30	00.11	20.83	23.33	16.85	1.09	12.68
	18	266	31	42.96	0.65	266	31	05.45	20.83	23.47	16.73	1.14	12.72
	19	267	32	48.64	0.72	267	32	11.18	20.83	23.61	16.67	1.19	12.78
	20	268	33	54.62	0.76	268	33	17.17	20.83	23.75	16.66	1.24	12.83
	21	269	35	00.92	0.79	269	34	23.45	20.83	23.88	16.69	1.28	12.86
	22	270	36	07.43	-0.79	270	35	29.90	20.84	+24.02	-16.74	+1.30	12.89
	23	271	37	14.16	0.76	271	36	36.58	20.84	24.16	16.79	1.31	12.89
	24	272	38	21.02	0.68	272	37	43.39	20.84	24.30	16.84	1.30	12.88
	25	273	39	28.07	0.58	273	38	50.42	20.84	24.44	16.86	1.28	12.86
	26	274	40	35.27	0.47	274	39	57.64	20.84	24.58	16.84	1.25	12.83
	27	275	41	42.58	0.36	275	41	04.99	20.84	24.72	16.79	1.22	12.80
	28	276	42	50.02	-0.22	276	42	12.53	20.84	+24.86	-16.70	+1.20	12.77
	29	277	43	57.58	-0.07	277	43	20.21	20.84	25.00	16.57	1.19	12.76
	30	278	45	05.29	+0.04	278	44	28.07	20.84	25.14	16.43	1.19	12.77
	31	279	46	13.15	0.18	279	45	36.07	20.84	25.27	16.28	1.22	12.79
	32	280	47	21.21	+0.29	280	46	44.26	20.84	+25.41	-16.16	+1.26	12.83

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -17' 10".958 and subtract precession from J 2020.5.

SUN, 2020
FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Semi Diameter		Ephemeris Transit		
		h	m	s	°	'	"		'	"	h	m	s
Nov.	16	15	26	50.68	-18	47	28.35	0.988 9502	16	10.37	11	44	50.41
	17	15	30	58.79	19	02	12.81	0.988 7321	16	10.58	11	45	02.36
	18	15	35	07.73	19	16	36.88	0.988 5159	16	10.79	11	45	15.14
	19	15	39	17.48	19	30	40.14	0.988 3020	16	11.00	11	45	28.72
	20	15	43	28.04	19	44	22.20	0.988 0907	16	11.21	11	45	43.11
	21	15	47	39.38	19	57	42.67	0.987 8824	16	11.42	11	45	58.28
	22	15	51	51.50	-20	10	41.18	0.987 6774	16	11.62	11	46	14.23
	23	15	56	04.39	20	23	17.39	0.987 4760	16	11.82	11	46	30.94
	24	16	00	18.04	20	35	30.93	0.987 2786	16	12.01	11	46	48.41
	25	16	04	32.44	20	47	21.48	0.987 0855	16	12.20	11	47	06.62
	26	16	08	47.57	20	58	48.72	0.986 8969	16	12.39	11	47	25.57
	27	16	13	03.43	21	09	52.33	0.986 7130	16	12.57	11	47	45.22
	28	16	17	19.99	-21	20	32.01	0.986 5342	16	12.74	11	48	05.59
	29	16	21	37.26	21	30	47.46	0.986 3605	16	12.92	11	48	26.63
	30	16	25	55.20	21	40	38.41	0.986 1921	16	13.08	11	48	48.35
Dec.	1	16	30	13.81	21	50	04.57	0.986 0291	16	13.24	11	49	10.72
	2	16	34	33.06	21	59	05.69	0.985 8716	16	13.40	11	49	33.73
	3	16	38	52.94	22	07	41.50	0.985 7196	16	13.55	11	49	57.35
	4	16	43	13.42	-22	15	51.74	0.985 5731	16	13.69	11	50	21.57
	5	16	47	34.49	22	23	36.18	0.985 4319	16	13.83	11	50	46.37
	6	16	51	56.12	22	30	54.56	0.985 2960	16	13.97	11	51	11.71
	7	16	56	18.29	22	37	46.65	0.985 1651	16	14.10	11	51	37.59
	8	17	00	40.97	22	44	12.22	0.985 0391	16	14.22	11	52	03.97
	9	17	05	04.14	22	50	11.05	0.984 9176	16	14.34	11	52	30.82
	10	17	09	27.76	-22	55	42.95	0.984 8004	16	14.46	11	52	58.12
	11	17	13	51.82	23	00	47.71	0.984 6872	16	14.57	11	53	25.84
	12	17	18	16.28	23	05	25.16	0.984 5777	16	14.68	11	53	53.94
	13	17	22	41.11	23	09	35.14	0.984 4716	16	14.78	11	54	22.38
	14	17	27	06.27	23	13	17.51	0.984 3688	16	14.88	11	54	51.14
	15	17	31	31.73	23	16	32.13	0.984 2692	16	14.98	11	55	20.16
	16	17	35	57.43	-23	19	18.88	0.984 1729	16	15.08	11	55	49.42
	17	17	40	23.35	23	21	37.65	0.984 0800	16	15.17	11	56	18.87
	18	17	44	49.43	23	23	28.34	0.983 9907	16	15.26	11	56	48.48
	19	17	49	15.65	23	24	50.86	0.983 9053	16	15.34	11	57	18.21
	20	17	53	41.97	23	25	45.15	0.983 8240	16	15.42	11	57	48.02
	21	17	58	08.35	23	26	11.17	0.983 7472	16	15.50	11	58	17.87
	22	18	02	34.76	-23	26	08.90	0.983 6751	16	15.57	11	58	47.74
	23	18	07	01.17	23	25	38.33	0.983 6080	16	15.64	11	59	17.59
	24	18	11	27.53	23	24	39.48	0.983 5462	16	15.70	11	59	47.38
	25	18	15	53.83	23	23	12.37	0.983 4899	16	15.75	12	00	17.09
	26	18	20	20.03	23	21	17.06	0.983 4393	16	15.80	12	00	46.68
	27	18	24	46.10	23	18	53.61	0.983 3946	16	15.85	12	01	16.12
	28	18	29	12.00	-23	16	02.10	0.983 3560	16	15.89	12	01	45.38
	29	18	33	37.71	23	12	42.62	0.983 3236	16	15.92	12	02	14.43
	30	18	38	03.20	23	08	55.27	0.983 2976	16	15.95	12	02	43.24
	31	18	42	28.43	23	04	40.18	0.983 2780	16	15.97	12	03	11.78
	32	18	46	53.38	-22	59	57.47	0.983 2649	16	15.98	12	03	40.02

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MEAN EQUATOR AND EQUINOX OF J 2020.5 AND J 2000.0

Date		$X_{2020.5}$	$X_{2000.0}$	$Y_{2020.5}$	$Y_{2000.0}$	$Z_{2020.5}$	$Z_{2000.0}$
Jan.	0	+0.149 8509	+0.149 0809	-0.891 7657	-0.891 7640	-0.386 2797	-0.386 5815
	1	0.167 1135	0.166 3458	0.889 1687	0.889 1670	0.385 1199	0.385 4561
	2	0.184 3227	0.183 5575	0.886 2947	0.886 2930	0.383 8400	0.384 2105
	3	0.201 4730	0.200 7105	0.883 1448	0.883 1431	0.382 4405	0.382 8451
	4	0.218 5591	0.217 7997	0.879 7203	0.879 7187	0.380 9219	0.381 3605
	5	0.235 5758	0.234 8196	0.876 0226	0.876 0209	0.379 2849	0.379 7574
	6	+0.252 5179	+0.251 7651	-0.872 0529	-0.872 0513	-0.377 5300	-0.378 0362
	7	0.269 3803	0.268 6313	0.867 8129	0.867 8113	0.375 6579	0.376 1977
	8	0.286 1580	0.285 4129	0.863 3040	0.863 3024	0.373 6693	0.374 2425
	9	0.302 8462	0.302 1052	0.858 5279	0.858 5263	0.371 5650	0.372 1714
	10	0.319 4399	0.318 7033	0.853 4861	0.853 4845	0.369 3457	0.369 9851
	11	0.335 9345	0.335 2025	0.848 1802	0.848 1787	0.367 0121	0.367 6844
	12	+0.352 3252	+0.351 5980	-0.842 6119	-0.842 6103	-0.364 5650	-0.365 2699
	13	0.368 6073	0.367 8853	0.836 7827	0.836 7811	0.362 0050	0.362 7424
	14	0.384 7762	0.384 0594	0.830 6941	0.830 6926	0.359 3331	0.360 1026
	15	0.400 8270	0.400 1158	0.824 3478	0.824 3463	0.356 5497	0.357 3512
	16	0.416 7550	0.416 0495	0.817 7453	0.817 7438	0.353 6557	0.354 4889
	17	0.432 5551	0.431 8555	0.810 8883	0.810 8868	0.350 6519	0.351 5165
	18	+0.448 2224	+0.447 5291	-0.803 7786	-0.803 7772	-0.347 5389	-0.348 4347
	19	0.463 7519	0.463 0649	0.796 4182	0.796 4168	0.344 3177	0.345 2444
	20	0.479 1385	0.478 4581	0.788 8091	0.788 8077	0.340 9891	0.341 9464
	21	0.494 3770	0.493 7034	0.780 9535	0.780 9521	0.337 5541	0.338 5417
	22	0.509 4625	0.508 7959	0.772 8540	0.772 8526	0.334 0136	0.335 0313
	23	0.524 3898	0.523 7305	0.764 5129	0.764 5115	0.330 3688	0.331 4162
	24	+0.539 1541	+0.538 5022	-0.755 9331	-0.755 9317	-0.326 6209	-0.327 6976
	25	0.553 7505	0.553 1062	0.747 1173	0.747 1160	0.322 7709	0.323 8767
	26	0.568 1742	0.567 5378	0.738 0687	0.738 0674	0.318 8203	0.319 9548
	27	0.582 4206	0.581 7922	0.728 7903	0.728 7890	0.314 7703	0.315 9332
	28	0.596 4851	0.595 8649	0.719 2853	0.719 2840	0.310 6224	0.311 8132
	29	0.610 3633	0.609 7516	0.709 5570	0.709 5557	0.306 3778	0.307 5963
	30	+0.624 0510	+0.623 4479	-0.699 6087	-0.699 6075	-0.302 0382	-0.303 2839
	31	0.637 5439	0.636 9497	0.689 4441	0.689 4429	0.297 6050	0.298 8775
Feb.	1	0.650 8381	0.650 2528	0.679 0664	0.679 0653	0.293 0797	0.294 3787
	2	0.663 9296	0.663 3535	0.668 4794	0.668 4783	0.288 4639	0.289 7889
	3	0.676 8146	0.676 2478	0.657 6866	0.657 6854	0.283 7592	0.285 1098
	4	0.689 4894	0.688 9321	0.646 6916	0.646 6905	0.278 9672	0.280 3430
	5	+0.701 9504	+0.701 4029	-0.635 4981	-0.635 4970	-0.274 0894	-0.275 4900
	6	0.714 1943	0.713 6566	0.624 1098	0.624 1088	0.269 1276	0.270 5526
	7	0.726 2178	0.725 6901	0.612 5303	0.612 5293	0.264 0834	0.265 5322
	8	0.738 0176	0.737 5002	0.600 7634	0.600 7624	0.258 9583	0.260 4306
	9	0.749 5907	0.749 0836	0.588 8125	0.588 8116	0.253 7540	0.255 2494
	10	0.760 9340	0.760 4374	0.576 6813	0.576 6804	0.248 4722	0.249 9900
	11	+0.772 0444	+0.771 5584	-0.564 3731	-0.564 3722	-0.243 1142	-0.244 6541
	12	0.782 9188	0.782 4437	0.551 8915	0.551 8907	0.237 6817	0.239 2432
	13	0.793 5541	0.793 0899	0.539 2400	0.539 2392	0.232 1761	0.233 7588
	14	0.803 9470	0.803 4939	0.526 4221	0.526 4213	0.226 5991	0.228 2025
	15	+0.814 0944	+0.813 6525	-0.513 4415	-0.513 4407	-0.220 9523	-0.222 5758

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MEAN EQUATOR AND EQUINOX OF J 2020.5 AND J 2000.0

Date		$X_{2020.5}$	$X_{2000.0}$	$Y_{2020.5}$	$Y_{2000.0}$	$Z_{2020.5}$	$Z_{2000.0}$
Feb.	15	+0.814 0944	+0.813 6525	-0.513 4415	-0.513 4407	-0.220 9523	-0.222 5758
	16	0.823 9928	0.823 5623	0.500 3019	0.500 3012	0.215 2371	0.216 8803
	17	0.833 6391	0.833 2201	0.487 0074	0.487 0066	0.209 4554	0.211 1178
	18	0.843 0302	0.842 6228	0.473 5619	0.473 5612	0.203 6088	0.205 2898
	19	0.852 1629	0.851 7673	0.459 9697	0.459 9690	0.197 6992	0.199 3984
	20	0.861 0342	0.860 6504	0.446 2350	0.446 2344	0.191 7283	0.193 4451
	21	+0.869 6412	+0.869 2695	-0.432 3623	-0.432 3617	-0.185 6982	-0.187 4320
	22	0.877 9813	0.877 6217	0.418 3561	0.418 3555	0.179 6105	0.181 3610
	23	0.886 0517	0.885 7043	0.404 2209	0.404 2204	0.173 4675	0.175 2339
	24	0.893 8500	0.893 5150	0.389 9615	0.389 9610	0.167 2710	0.169 0529
	25	0.901 3739	0.901 0513	0.375 5825	0.375 5820	0.161 0231	0.162 8199
	26	0.908 6212	0.908 3111	0.361 0886	0.361 0882	0.154 7258	0.156 5370
	27	+0.915 5898	+0.915 2923	-0.346 4848	-0.346 4843	-0.148 3812	-0.150 2063
	28	0.922 2779	0.921 9932	0.331 7756	0.331 7753	0.141 9914	0.143 8297
	29	0.928 6837	0.928 4118	0.316 9661	0.316 9657	0.135 5585	0.137 4096
Mar.	1	0.934 8057	0.934 5466	0.302 0610	0.302 0606	0.129 0846	0.130 9478
	2	0.940 6423	0.940 3962	0.287 0650	0.287 0647	0.122 5719	0.124 4466
	3	0.946 1922	0.945 9592	0.271 9832	0.271 9829	0.116 0223	0.117 9081
	4	+0.951 4544	+0.951 2344	-0.256 8201	-0.256 8199	-0.109 4381	-0.111 3342
	5	0.956 4276	0.956 2209	0.241 5806	0.241 5804	0.102 8212	0.104 7273
	6	0.961 1111	0.960 9176	0.226 2693	0.226 2691	0.096 1739	0.098 0892
	7	0.965 5041	0.965 3238	0.210 8909	0.210 8908	0.089 4981	0.091 4221
	8	0.969 6057	0.969 4388	0.195 4499	0.195 4498	0.082 7959	0.084 7280
	9	0.973 4155	0.973 2620	0.179 9508	0.179 9507	0.076 0691	0.078 0087
	10	+0.976 9326	+0.976 7926	-0.164 3978	-0.164 3978	-0.069 3198	-0.071 2663
	11	0.980 1565	0.980 0299	0.148 7953	0.148 7953	0.062 5497	0.064 5026
	12	0.983 0864	0.982 9733	0.133 1475	0.133 1476	0.055 7608	0.057 7195
	13	0.985 7214	0.985 6219	0.117 4589	0.117 4589	0.048 9549	0.050 9188
	14	0.988 0608	0.987 9749	0.101 7337	0.101 7338	0.042 1339	0.044 1025
	15	0.990 1037	0.990 0314	0.085 9765	0.085 9767	0.035 2998	0.037 2723
	16	+0.991 8494	+0.991 7907	-0.070 1920	-0.070 1922	-0.028 4545	-0.030 4304
	17	0.993 2972	0.993 2522	0.054 3849	0.054 3851	0.021 5999	0.023 5787
	18	0.994 4465	0.994 4152	0.038 5599	0.038 5601	0.014 7383	0.016 7193
	19	0.995 2969	0.995 2792	0.022 7219	0.022 7222	0.007 8716	0.009 8542
	20	0.995 8481	0.995 8441	-0.006 8760	-0.006 8762	-0.001 0019	-0.002 9856
	21	0.996 0999	0.996 1096	+0.008 9731	+0.008 9728	+0.005 8685	+0.003 8844
	22	+0.996 0524	+0.996 0758	+0.024 8203	+0.024 8199	+0.012 7377	+0.010 7537
	23	0.995 7055	0.995 7426	0.040 6605	0.040 6602	0.019 6034	0.017 6202
	24	0.995 0597	0.995 1105	0.056 4889	0.056 4885	0.026 4635	0.024 4816
	25	0.994 1153	0.994 1798	0.072 3003	0.072 2999	0.033 3158	0.031 3359
	26	0.992 8730	0.992 9510	0.088 0899	0.088 0895	0.040 1582	0.038 1808
	27	0.991 3333	0.991 4249	0.103 8527	+0.103 8522	0.046 9885	0.045 0142
	28	+0.989 4971	+0.989 6024	+0.119 5837	+0.119 5831	+0.053 8045	+0.051 8340
	29	0.987 3655	0.987 4843	0.135 2780	0.135 2775	0.060 6042	0.058 6380
	30	0.984 9396	0.985 0719	0.150 9309	0.150 9304	0.067 3854	0.065 4241
	31	0.982 2206	0.982 3664	0.166 5377	0.166 5370	0.074 1461	0.072 1902
Apr.	1	+0.979 2099	+0.979 3691	+0.182 0935	+0.182 0928	+0.080 8841	+0.078 9343

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MEAN EQUATOR AND EQUINOX OF J 2020.5 AND J 2000.0

Date		$X_{2020.5}$	$X_{2000.0}$	$Y_{2020.5}$	$Y_{2000.0}$	$Z_{2020.5}$	$Z_{2000.0}$
Apr.	1	+0.979 2099	+0.979 3691	+0.182 0935	+0.182 0928	+0.080 8841	+0.078 9343
	2	0.975 9089	0.976 0816	0.197 5938	0.197 5932	0.087 5975	0.085 6543
	3	0.972 3194	0.972 5054	0.213 0342	0.213 0335	0.094 2843	0.092 3483
	4	0.968 4430	0.968 6422	0.228 4102	0.228 4095	0.100 9425	0.099 0143
	5	0.964 2814	0.964 4938	0.243 7175	0.243 7168	0.107 5703	0.105 6504
	6	0.959 8364	0.960 0620	0.258 9521	0.258 9513	0.114 1658	0.112 2549
	7	+0.955 1098	+0.955 3484	+0.274 1099	+0.274 1091	+0.120 7273	+0.118 8258
	8	0.950 1032	0.950 3549	0.289 1869	0.289 1860	0.127 2531	0.125 3616
	9	0.944 8185	0.945 0831	0.304 1792	0.304 1783	0.133 7413	0.131 8605
	10	0.939 2570	0.939 5345	0.319 0829	0.319 0820	0.140 1905	0.138 3208
	11	0.933 4203	0.933 7106	0.333 8940	0.333 8930	0.146 5989	0.144 7408
	12	0.927 3101	0.927 6131	0.348 6084	0.348 6074	0.152 9647	0.151 1188
	13	+0.920 9279	+0.921 2435	+0.363 2219	+0.363 2209	+0.159 2862	+0.157 4531
	14	0.914 2754	0.914 6034	0.377 7304	0.377 7294	0.165 5616	0.163 7418
	15	0.907 3543	0.907 6948	0.392 1296	0.392 1286	0.171 7891	0.169 9832
	16	0.900 1668	0.900 5196	0.406 4152	0.406 4141	0.177 9670	0.176 1754
	17	0.892 7147	0.893 0797	0.420 5829	0.420 5818	0.184 0932	0.182 3166
	18	0.885 0003	0.885 3774	0.434 6284	0.434 6273	0.190 1661	0.188 4049
	19	+0.877 0259	+0.877 4151	+0.448 5475	+0.448 5463	+0.196 1839	+0.194 4385
	20	0.868 7940	0.869 1950	0.462 3359	0.462 3347	0.202 1445	0.200 4157
	21	0.860 3071	0.860 7199	0.475 9894	0.475 9882	0.208 0464	0.206 3345
	22	0.851 5679	0.851 9924	0.489 5040	0.489 5027	0.213 8876	0.212 1932
	23	0.842 5793	0.843 0153	0.502 8754	0.502 8741	0.219 6665	0.217 9900
	24	0.833 3442	0.833 7916	0.516 0997	0.516 0984	0.225 3812	0.223 7231
	25	+0.823 8657	+0.824 3244	+0.529 1729	+0.529 1716	+0.231 0300	+0.229 3909
	26	0.814 1469	0.814 6167	0.542 0911	0.542 0898	0.236 6112	0.234 9915
	27	0.804 1911	0.804 6719	0.554 8506	0.554 8493	0.242 1233	0.240 5234
	28	0.794 0017	0.794 4934	0.567 4477	0.567 4464	0.247 5644	0.245 9850
	29	0.783 5822	0.784 0847	0.579 8789	0.579 8775	0.252 9332	0.251 3745
	30	0.772 9362	0.773 4492	0.592 1406	0.592 1392	0.258 2280	0.256 6906
May	1	+0.762 0672	+0.762 5907	+0.604 2295	+0.604 2281	+0.263 4474	+0.261 9317
	2	0.750 9790	0.751 5127	0.616 1426	0.616 1412	0.268 5901	0.267 0965
	3	0.739 6751	0.740 2190	0.627 8767	0.627 8753	0.273 6545	0.272 1835
	4	0.728 1593	0.728 7131	0.639 4290	0.639 4275	0.278 6396	0.277 1915
	5	0.716 4352	0.716 9987	0.650 7967	0.650 7952	0.283 5440	0.282 1194
	6	0.704 5062	0.705 0794	0.661 9770	0.661 9755	0.288 3667	0.286 9658
	7	+0.692 3759	+0.692 9585	+0.672 9673	+0.672 9657	+0.293 1063	+0.291 7297
	8	0.680 0475	0.680 6395	0.683 7649	0.683 7634	0.297 7620	0.296 4099
	9	0.667 5245	0.668 1256	0.694 3672	0.694 3656	0.302 3324	0.301 0054
	10	0.654 8101	0.655 4202	0.704 7713	0.704 7697	0.306 8166	0.305 5148
	11	0.641 9077	0.642 5266	0.714 9745	0.714 9729	0.311 2132	0.309 9372
	12	0.628 8207	0.629 4482	0.724 9739	0.724 9723	0.315 5211	0.314 2713
	13	+0.615 5527	+0.616 1885	+0.734 7666	+0.734 7649	+0.319 7392	+0.318 5158
	14	0.602 1071	0.602 7513	0.744 3497	0.744 3480	0.323 8661	0.322 6695
	15	0.588 4879	0.589 1401	0.753 7204	0.753 7187	0.327 9007	0.326 7313
	16	0.574 6987	0.575 3588	0.762 8759	0.762 8742	0.331 8418	0.330 6999
	17	+0.560 7437	+0.561 4115	+0.771 8134	+0.771 8117	+0.335 6883	+0.334 5742

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EQUATORIAL RECTANGULAR CO-ORDINATES FOR 0^h TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2020.5 AND J 2000.0

Date		$X_{2020.5}$	$X_{2000.0}$	$Y_{2020.5}$	$Y_{2000.0}$	$Z_{2020.5}$	$Z_{2000.0}$
May	17	+0.560 7437	+0.561 4115	+0.771 8134	+0.771 8117	+0.335 6883	+0.334 5742
	18	0.546 6267	0.547 3020	0.780 5303	0.780 5286	0.339 4389	0.338 3529
	19	0.532 3520	0.533 0346	0.789 0238	0.789 0221	0.343 0925	0.342 0350
	20	0.517 9238	0.518 6135	0.797 2915	0.797 2898	0.346 6481	0.345 6194
	21	0.503 3464	0.504 0431	0.805 3308	0.805 3290	0.350 1045	0.349 1048
	22	+0.488 6243	0.489 3276	0.813 1393	0.813 1376	0.353 4606	0.352 4904
	23	+0.473 7618	+0.474 4716	+0.820 7148	+0.820 7131	+0.356 7156	+0.355 7750
	24	0.458 7636	0.459 4798	0.828 0551	0.828 0533	0.359 8684	0.358 9576
	25	0.443 6344	0.444 3567	0.835 1580	0.835 1562	0.362 9181	0.362 0375
	26	0.428 3789	0.429 1071	0.842 0217	0.842 0199	0.365 8638	0.365 0136
	27	0.413 0019	0.413 7358	0.848 6443	0.848 6425	0.368 7047	0.367 8852
	28	0.397 5081	0.398 2474	0.855 0242	0.855 0224	0.371 4401	0.370 6514
	29	+0.381 9024	+0.382 6470	+0.861 1598	+0.861 1580	+0.374 0693	+0.373 3117
	30	0.366 1895	0.366 9391	0.867 0499	0.867 0480	0.376 5916	0.375 8654
	31	0.350 3742	0.351 1287	0.872 6931	0.872 6912	0.379 0066	0.378 3119
June	1	0.334 4612	0.335 2203	0.878 0883	0.878 0865	0.381 3137	0.380 6508
	2	0.318 4550	0.319 2186	0.883 2346	0.883 2327	0.383 5126	0.382 8815
	3	0.302 3602	0.303 1280	0.888 1309	0.888 1291	0.385 6027	0.385 0038
	4	+0.286 1812	+0.286 9530	+0.892 7765	+0.892 7746	+0.387 5839	+0.387 0171
	5	0.269 9223	0.270 6978	0.897 1703	0.897 1685	0.389 4556	0.388 9212
	6	0.253 5877	0.254 3667	0.901 3115	0.901 3096	0.391 2176	0.390 7158
	7	0.237 1816	0.237 9640	0.905 1990	0.905 1972	0.392 8694	0.392 4003
	8	0.220 7083	0.221 4938	0.908 8319	0.908 8301	0.394 4107	0.393 9745
	9	0.204 1721	0.204 9605	0.912 2091	0.912 2072	0.395 8411	0.395 4378
	10	+0.187 5774	+0.188 3684	+0.915 3295	+0.915 3277	+0.397 1602	+0.396 7900
	11	0.170 9285	0.171 7219	0.918 1922	0.918 1903	0.398 3675	0.398 0305
	12	0.154 2300	0.155 0257	0.920 7961	0.920 7942	0.399 4627	0.399 1589
	13	0.137 4865	0.138 2842	0.923 1403	0.923 1384	0.400 4454	0.400 1750
	14	0.120 7027	0.121 5022	0.925 2239	0.925 2220	0.401 3152	0.401 0782
	15	0.103 8834	0.104 6843	0.927 0461	0.927 0443	0.402 0718	0.401 8683
	16	+0.087 0332	+0.087 8355	+0.928 6063	+0.928 6045	+0.402 7148	+0.402 5449
	17	0.070 1571	0.070 9605	0.929 9038	0.929 9019	0.403 2441	0.403 1078
	18	0.053 2601	0.054 0643	0.930 9380	0.930 9362	0.403 6593	0.403 5566
	19	0.036 3469	0.037 1518	0.931 7086	0.931 7067	0.403 9602	0.403 8913
	20	0.019 4228	0.020 2281	0.932 2151	0.932 2132	0.404 1468	0.404 1116
	21	+0.002 4928	+0.003 2983	0.932 4574	0.932 4555	0.404 2189	0.404 2173
	22	-0.014 4380	-0.013 6326	+0.932 4353	+0.932 4335	+0.404 1763	+0.404 2085
	23	0.031 3645	0.030 5594	0.932 1490	0.932 1471	0.404 0192	0.404 0851
	24	0.048 2815	0.047 4769	0.931 5986	0.931 5967	0.403 7476	0.403 8472
	25	0.065 1839	0.064 3801	0.930 7845	0.930 7826	0.403 3616	0.403 4948
	26	0.082 0667	0.081 2638	0.929 7072	0.929 7054	0.402 8614	0.403 0283
	27	0.098 9247	0.098 1230	0.928 3674	0.928 3656	0.402 2472	0.402 4477
	28	-0.115 7532	-0.114 9529	+0.926 7658	+0.926 7640	+0.401 5195	+0.401 7535
	29	0.132 5474	0.131 7487	0.924 9033	0.924 9015	0.400 6786	0.400 9461
	30	0.149 3025	0.148 5057	0.922 7809	0.922 7791	0.399 7249	0.400 0258
July	1	0.166 0140	0.165 2193	0.920 3995	0.920 3978	0.398 6589	0.398 9930
	2	-0.182 6775	-0.181 8851	+0.917 7602	+0.917 7584	+0.397 4810	+0.397 8483

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MEAN EQUATOR AND EQUINOX OF J 2020.5 AND J 2000.0

Date		$X_{2020.5}$	$X_{2000.0}$	$Y_{2020.5}$	$Y_{2000.0}$	$Z_{2020.5}$	$Z_{2000.0}$
July	1	-0.166 0140	-0.165 2193	+0.920 3995	+0.920 3978	+0.398 6589	+0.398 9930
	2	0.182 6775	0.181 8851	0.917 7602	0.917 7584	0.397 4810	0.397 8483
	3	0.199 2887	0.198 4988	0.914 8638	0.914 8621	0.396 1918	0.396 5921
	4	0.215 8432	0.215 0561	0.911 7114	0.911 7097	0.394 7916	0.395 2249
	5	0.232 3369	0.231 5528	0.908 3039	0.908 3022	0.393 2809	0.393 7471
	6	0.248 7655	0.247 9846	0.904 6422	0.904 6405	0.391 6602	0.392 1591
	7	-0.265 1247	-0.264 3472	+0.900 7271	+0.900 7254	+0.389 9298	+0.390 4613
	8	0.281 4103	0.280 6364	0.896 5595	0.896 5578	0.388 0903	0.388 6542
	9	0.297 6178	0.296 8478	0.892 1404	0.892 1387	0.386 1420	0.386 7382
	10	0.313 7429	0.312 9769	0.887 4706	0.887 4689	0.384 0854	0.384 7136
	11	0.329 7811	0.329 0195	0.882 5512	0.882 5496	0.381 9208	0.382 5810
	12	0.345 7280	0.344 9708	0.877 3833	0.877 3817	0.379 6489	0.380 3408
	13	-0.361 5789	-0.360 8265	+0.871 9680	+0.871 9664	+0.377 2701	+0.377 9936
	14	0.377 3294	0.376 5819	0.866 3066	0.866 3049	0.374 7849	0.375 5397
	15	0.392 9749	0.392 2325	0.860 4003	0.860 3987	0.372 1939	0.372 9798
	16	0.408 5107	0.407 7736	0.854 2506	0.854 2490	0.369 4977	0.370 3146
	17	0.423 9322	0.423 2007	0.847 8589	0.847 8574	0.366 6969	0.367 5445
	18	0.439 2348	0.438 5091	0.841 2270	0.841 2254	0.363 7923	0.364 6703
	19	-0.454 4139	-0.453 6941	+0.834 3565	+0.834 3549	+0.360 7845	+0.361 6927
	20	0.469 4647	0.468 7510	0.827 2492	0.827 2477	0.357 6743	0.358 6125
	21	0.484 3825	0.483 6753	0.819 9073	0.819 9058	0.354 4626	0.355 4305
	22	0.499 1629	0.498 4622	0.812 3328	0.812 3313	0.351 1502	0.352 1475
	23	0.513 8012	0.513 1072	0.804 5281	0.804 5266	0.347 7382	0.348 7647
	24	0.528 2929	0.527 6060	0.796 4956	0.796 4941	0.344 2276	0.345 2829
	25	-0.542 6339	-0.541 9541	+0.788 2379	+0.788 2365	+0.340 6195	+0.341 7033
	26	0.556 8198	0.556 1474	0.779 7577	0.779 7563	0.336 9151	0.338 0272
	27	0.570 8468	0.570 1819	0.771 0577	0.771 0563	0.333 1156	0.334 2555
	28	0.584 7109	0.584 0537	0.762 1406	0.762 1393	0.329 2221	0.330 3896
	29	0.598 4084	0.597 7592	0.753 0093	0.753 0080	0.325 2360	0.326 4307
	30	0.611 9358	0.611 2947	0.743 6665	0.743 6652	0.321 1584	0.322 3801
	31	-0.625 2895	-0.624 6566	+0.734 1149	+0.734 1136	+0.316 9905	+0.318 2388
Aug.	1	0.638 4661	0.637 8417	0.724 3571	0.724 3559	0.312 7337	0.314 0082
	2	0.651 4622	0.650 8464	0.714 3959	0.714 3947	0.308 3891	0.309 6894
	3	0.664 2744	0.663 6674	0.704 2338	0.704 2326	0.303 9577	0.305 2835
	4	0.676 8993	0.676 3013	0.693 8735	0.693 8723	0.299 4410	0.300 7919
	5	0.689 3336	0.688 7447	0.683 3175	0.683 3164	0.294 8399	0.296 2155
	6	-0.701 5737	-0.700 9942	+0.672 5686	+0.672 5674	+0.290 1556	+0.291 5556
	7	0.713 6164	0.713 0463	0.661 6293	0.661 6282	0.285 3894	0.286 8134
	8	0.725 4581	0.724 8977	0.650 5024	0.650 5013	0.280 5425	0.281 9899
	9	0.737 0954	0.736 5447	0.639 1907	0.639 1897	0.275 6159	0.277 0865
	10	0.748 5248	0.747 9841	0.627 6971	0.627 6961	0.270 6111	0.272 1044
	11	0.759 7428	0.759 2122	0.616 0244	0.616 0234	0.265 5292	0.267 0448
	12	-0.770 7460	-0.770 2257	+0.604 1757	+0.604 1747	+0.260 3715	+0.261 9090
	13	0.781 5310	0.781 0210	0.592 1541	0.592 1531	0.255 1393	0.256 6983
	14	0.792 0942	0.791 5948	0.579 9627	0.579 9618	0.249 8341	0.251 4140
	15	0.802 4324	0.801 9437	0.567 6048	0.567 6039	0.244 4571	0.246 0576
	16	-0.812 5420	-0.812 0641	+0.555 0837	+0.555 0828	+0.239 0099	+0.240 6305

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MEAN EQUATOR AND EQUINOX OF J 2020.5 AND J 2000.0

Date		$X_{2020.5}$	$X_{2000.0}$	$Y_{2020.5}$	$Y_{2000.0}$	$Z_{2020.5}$	$Z_{2000.0}$
Aug.	16	-0.812 5420	-0.812 0641	+0.555 0837	+0.555 0828	+0.239 0099	+0.240 6305
	17	0.822 4196	0.821 9527	0.542 4030	0.542 4022	0.233 4939	0.235 1341
	18	0.832 0621	0.831 6063	0.529 5663	0.529 5655	0.227 9107	0.229 5700
	19	0.841 4660	0.841 0214	0.516 5774	0.516 5766	0.222 2618	0.223 9398
	20	0.850 6283	0.850 1951	0.503 4401	0.503 4393	0.216 5489	0.218 2452
	21	0.859 5459	0.859 1242	0.490 1585	0.490 1577	0.210 7738	0.212 4878
	22	-0.868 2161	-0.867 8060	+0.476 7367	+0.476 7360	+0.204 9383	+0.206 6695
	23	0.876 6362	0.876 2378	0.463 1789	0.463 1782	0.199 0441	0.200 7920
	24	0.884 8038	0.884 4173	0.449 4893	0.449 4887	0.193 0931	0.194 8573
	25	0.892 7166	0.892 3421	0.435 6721	0.435 6715	0.187 0872	0.188 8670
	26	0.900 3726	0.900 0101	0.421 7313	0.421 7308	0.181 0282	0.182 8232
	27	0.907 7697	0.907 4194	0.407 6712	0.407 6707	0.174 9178	0.176 7275
	28	-0.914 9062	-0.914 5681	+0.393 4956	+0.393 4951	+0.168 7579	+0.170 5818
	29	0.921 7800	0.921 4543	0.379 2087	0.379 2082	0.162 5503	0.164 3878
	30	0.928 3895	0.928 0762	0.364 8142	0.364 8137	0.156 2966	0.158 1472
	31	0.934 7329	0.934 4321	0.350 3160	0.350 3156	0.149 9986	0.151 8618
Sept.	1	0.940 8084	0.940 5203	0.335 7182	0.335 7178	0.143 6580	0.145 5333
	2	0.946 6143	0.946 3389	0.321 0244	0.321 0241	0.137 2765	0.139 1633
	3	-0.952 1489	-0.951 8863	+0.306 2387	+0.306 2384	+0.130 8558	+0.132 7536
	4	0.957 4105	0.957 1607	0.291 3649	0.291 3646	0.124 3977	0.126 3058
	5	0.962 3974	0.962 1605	0.276 4069	0.276 4067	0.117 9037	0.119 8218
	6	0.967 1078	0.966 8839	0.261 3688	0.261 3686	0.111 3757	0.113 3031
	7	0.971 5401	0.971 3293	0.246 2545	0.246 2543	0.104 8153	0.106 7515
	8	0.975 6927	0.975 4950	0.231 0682	0.231 0680	0.098 2244	0.100 1688
	9	-0.979 5639	-0.979 3794	+0.215 8140	+0.215 8138	+0.091 6046	+0.093 5567
	10	0.983 1522	0.982 9809	0.200 4960	0.200 4959	0.084 9579	0.086 9170
	11	0.986 4560	0.986 2980	0.185 1185	0.185 1185	0.078 2860	0.080 2516
	12	0.989 4738	0.989 3292	0.169 6860	0.169 6859	0.071 5907	0.073 5623
	13	0.992 2043	0.992 0730	0.154 2027	0.154 2027	0.064 8741	0.066 8510
	14	0.994 6459	0.994 5281	0.138 6732	0.138 6732	0.058 1378	0.060 1196
	15	-0.996 7974	-0.996 6931	+0.123 1022	+0.123 1023	+0.051 3841	+0.053 3701
	16	0.998 6576	0.998 5668	0.107 4943	0.107 4944	0.044 6148	0.046 6044
	17	1.000 2254	1.000 1481	0.091 8545	0.091 8546	0.037 8321	0.039 8248
	18	1.001 5000	1.001 4362	0.076 1876	0.076 1877	0.031 0380	0.033 0332
	19	1.002 4806	1.002 4303	0.060 4986	0.060 4988	0.024 2348	0.026 2319
	20	1.003 1669	1.003 1301	0.044 7926	0.044 7928	0.017 4246	0.019 4230
	21	-1.003 5585	-1.003 5354	+0.029 0744	+0.029 0747	+0.010 6096	+0.012 6087
	22	1.003 6555	1.003 6460	+0.013 3491	+0.013 3494	+0.003 7920	+0.005 7912
	23	1.003 4580	1.003 4621	-0.002 3787	-0.002 3784	-0.003 0262	-0.001 0274
	24	1.002 9663	1.002 9839	0.018 1042	0.018 1038	0.009 8428	0.007 8450
	25	1.002 1805	1.002 2117	0.033 8228	0.033 8224	0.016 6558	0.014 6597
	26	1.001 1012	1.001 1460	0.049 5300	0.049 5297	0.023 4633	0.021 4693
	27	-0.999 7286	-0.999 7870	-0.065 2214	-0.065 2210	-0.030 2632	-0.028 2721
	28	0.998 0633	0.998 1351	0.080 8926	0.080 8921	0.037 0537	0.035 0659
	29	0.996 1056	0.996 1910	0.096 5391	0.096 5386	0.043 8327	0.041 8489
	30	0.993 8561	0.993 9549	0.112 1566	0.112 1561	0.050 5985	0.048 6192
Oct.	1	-0.991 3152	-0.991 4275	-0.127 7408	-0.127 7403	-0.057 3491	-0.055 3750

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Date		$X_{2020.5}$	$X_{2000.0}$	$Y_{2020.5}$	$Y_{2000.0}$	$Z_{2020.5}$	$Z_{2000.0}$
Oct.	1	-0.991 3152	-0.991 4275	-0.127 7408	-0.127 7403	-0.057 3491	-0.055 3750
	2	0.988 4834	0.988 6092	0.143 2874	0.143 2868	0.064 0827	0.062 1142
	3	0.985 3614	0.985 5005	0.158 7919	0.158 7913	0.070 7973	0.068 8351
	4	0.981 9497	0.982 1022	0.174 2501	0.174 2495	0.077 4912	0.075 5358
	5	0.978 2489	0.978 4146	0.189 6575	0.189 6569	0.084 1624	0.082 2145
	6	0.974 2597	0.974 4387	0.205 0099	0.205 0092	0.090 8090	0.088 8691
	7	-0.969 9827	-0.970 1749	-0.220 3027	-0.220 3020	-0.097 4292	-0.095 4979
	8	0.965 4187	0.965 6241	0.235 5315	0.235 5308	0.104 0210	0.102 0988
	9	0.960 5686	0.960 7871	0.250 6919	0.250 6911	0.110 5826	0.108 6702
	10	0.955 4332	0.955 6646	0.265 7792	0.265 7784	0.117 1120	0.115 2099
	11	0.950 0134	0.950 2578	0.280 7889	0.280 7881	0.123 6073	0.121 7160
	12	0.944 3102	0.944 5675	0.295 7165	0.295 7156	0.130 0665	0.128 1866
	13	-0.938 3248	-0.938 5949	-0.310 5571	-0.310 5562	-0.136 4875	-0.134 6196
	14	0.932 0584	0.932 3413	0.325 3060	0.325 3051	0.142 8684	0.141 0131
	15	0.925 5124	0.925 8079	0.339 9584	0.339 9574	0.149 2071	0.147 3648
	16	0.918 6883	0.918 9964	0.354 5094	0.354 5084	0.155 5015	0.153 6728
	17	0.911 5880	0.911 9085	0.368 9541	0.368 9531	0.161 7494	0.159 9349
	18	0.904 2136	0.904 5464	0.383 2877	0.383 2866	0.167 9487	0.166 1490
	19	-0.896 5671	-0.896 9123	-0.397 5054	-0.397 5043	-0.174 0974	-0.172 3130
	20	0.888 6513	0.889 0085	0.411 6026	0.411 6016	0.180 1934	0.178 4248
	21	0.880 4685	0.880 8378	0.425 5749	0.425 5738	0.186 2348	0.184 4825
	22	0.872 0215	0.872 4028	0.439 4180	0.439 4168	0.192 2195	0.190 4842
	23	0.863 3130	0.863 7061	0.453 1275	0.453 1264	0.198 1459	0.196 4279
	24	0.854 3458	0.854 7506	0.466 6996	0.466 6984	0.204 0120	0.202 3120
	25	-0.845 1226	-0.845 5390	-0.480 1302	-0.480 1290	-0.209 8162	-0.208 1346
	26	0.835 6462	0.836 0741	0.493 4153	0.493 4141	0.215 5567	0.213 8940
	27	0.825 9195	0.826 3587	0.506 5513	0.506 5500	0.221 2319	0.219 5886
	28	0.815 9453	0.816 3957	0.519 5341	0.519 5328	0.226 8400	0.225 2167
	29	0.805 7263	0.806 1878	0.532 3602	0.532 3589	0.232 3796	0.230 7766
	30	0.795 2656	0.795 7379	0.545 0257	0.545 0244	0.237 8490	0.236 2669
	31	-0.784 5659	-0.785 0490	-0.557 5270	-0.557 5257	-0.243 2465	-0.241 6858
Nov.	1	0.773 6301	0.774 1239	0.569 8604	0.569 8591	0.248 5708	0.247 0319
	2	0.762 4613	0.762 9656	0.582 0223	0.582 0209	0.253 8201	0.252 3035
	3	0.751 0624	0.751 5770	0.594 0090	0.594 0076	0.258 9929	0.257 4991
	4	0.739 4365	0.739 9612	0.605 8170	0.605 8155	0.264 0878	0.262 6171
	5	0.727 5864	0.728 1212	0.617 4425	0.617 4410	0.269 1031	0.267 6561
	6	-0.715 5155	-0.716 0601	-0.628 8819	-0.628 8805	-0.274 0374	-0.272 6145
	7	0.703 2268	0.703 7811	0.640 1317	0.640 1302	0.278 8891	0.277 4907
	8	0.690 7236	0.691 2874	0.651 1881	0.651 1866	0.283 6566	0.282 2831
	9	0.678 0092	0.678 5824	0.662 0476	0.662 0460	0.288 3384	0.286 9903
	10	0.665 0870	0.665 6694	0.672 7063	0.672 7048	0.292 9330	0.291 6107
	11	0.651 9606	0.652 5520	0.683 1607	0.683 1591	0.297 4387	0.296 1426
	12	-0.638 6337	-0.639 2339	-0.693 4070	-0.693 4054	-0.301 8541	-0.300 5845
	13	0.625 1100	0.625 7189	0.703 4415	0.703 4399	0.306 1774	0.304 9348
	14	0.611 3937	0.612 0110	0.713 2606	0.713 2590	0.310 4071	0.309 1919
	15	0.597 4891	0.598 1147	0.722 8608	0.722 8592	0.314 5416	0.313 3541
	16	-0.583 4006	-0.584 0343	-0.732 2386	-0.732 2370	-0.318 5795	-0.317 4201

SUN, 2020
EQUATORIAL RECTANGULAR CO-ORDINATES FOR 0^h TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2020.5 AND J 2000.0

Date		$X_{2020.5}$	$X_{2000.0}$	$Y_{2020.5}$	$Y_{2000.0}$	$Z_{2020.5}$	$Z_{2000.0}$
Nov.	16	-0.583 4006	-0.584 0343	-0.732 2386	-0.732 2370	-0.318 5795	-0.317 4201
	17	0.569 1328	0.569 7743	0.741 3908	0.741 3891	0.322 5193	0.321 3884
	18	0.554 6905	0.555 3397	0.750 3144	0.750 3127	0.326 3596	0.325 2575
	19	0.540 0783	0.540 7350	0.759 0065	0.759 0048	0.330 0993	0.329 0263
	20	0.525 3011	0.525 9651	0.767 4644	0.767 4628	0.333 7370	0.332 6934
	21	0.510 3637	0.511 0347	0.775 6857	0.775 6840	0.337 2716	0.336 2579
	22	-0.495 2708	-0.495 9487	-0.783 6679	-0.783 6662	-0.340 7022	-0.339 7186
	23	0.480 0271	0.480 7116	0.791 4087	0.791 4070	0.344 0277	0.343 0745
	24	0.464 6373	0.465 3283	0.798 9059	0.798 9042	0.347 2471	0.346 3246
	25	0.449 1062	0.449 8034	0.806 1573	0.806 1555	0.350 3596	0.349 4680
	26	0.433 4383	0.434 1416	0.813 1608	0.813 1590	0.353 3642	0.352 5038
	27	0.417 6384	0.418 3475	0.819 9143	0.819 9126	0.356 2600	0.355 4312
	28	-0.401 7112	-0.402 4259	-0.826 4161	-0.826 4143	-0.359 0463	-0.358 2492
	29	0.385 6614	0.386 3814	0.832 6640	0.832 6622	0.361 7223	0.360 9571
	30	0.369 4935	0.370 2187	0.838 6563	0.838 6545	0.364 2871	0.363 5542
Dec.	1	0.353 2123	0.353 9424	0.844 3910	0.844 3893	0.366 7400	0.366 0396
	2	0.336 8225	0.337 5573	0.849 8666	0.849 8648	0.369 0803	0.368 4125
	3	0.320 3287	0.321 0680	0.855 0810	0.855 0792	0.371 3073	0.370 6724
	4	-0.303 7357	-0.304 4792	-0.860 0327	-0.860 0309	-0.373 4202	-0.372 8183
	5	0.287 0481	0.287 7956	0.864 7199	0.864 7181	0.375 4183	0.374 8497
	6	0.270 2709	0.271 0222	0.869 1408	0.869 1390	0.377 3010	0.376 7659
	7	0.253 4088	0.254 1636	0.873 2938	0.873 2920	0.379 0675	0.378 5660
	8	0.236 4668	0.237 2249	0.877 1773	0.877 1755	0.380 7171	0.380 2494
	9	0.219 4499	-0.220 2111	0.880 7894	0.880 7876	0.382 2492	0.381 8154
	10	-0.202 3633	-0.203 1273	-0.884 1288	-0.884 1270	-0.383 6631	-0.383 2632
	11	0.185 2122	0.185 9789	0.887 1937	0.887 1919	0.384 9580	0.384 5924
	12	0.168 0021	0.168 7712	0.889 9829	0.889 9811	0.386 1334	0.385 8021
	13	0.150 7386	0.151 5098	0.892 4949	0.892 4931	0.387 1887	0.386 8917
	14	0.133 4274	0.134 2005	0.894 7286	0.894 7268	0.388 1233	0.387 8609
	15	0.116 0742	0.116 8490	0.896 6832	0.896 6814	0.388 9369	0.388 7090
	16	-0.098 6850	-0.099 4611	-0.898 3579	-0.898 3561	-0.389 6290	-0.389 4357
	17	0.081 2654	0.082 0428	0.899 7521	0.899 7503	0.390 1994	0.390 0408
	18	0.063 8214	0.064 5997	0.900 8655	0.900 8637	0.390 6479	0.390 5241
	19	0.046 3586	0.047 1376	0.901 6980	0.901 6963	0.390 9745	0.390 8855
	20	0.028 8828	0.029 6622	0.902 2496	0.902 2478	0.391 1791	0.391 1249
	21	-0.011 3994	-0.012 1790	0.902 5202	0.902 5184	0.391 2618	0.391 2425
	22	+0.006 0861	+0.005 3065	-0.902 5101	-0.902 5083	-0.391 2226	-0.391 2381
	23	0.023 5681	0.022 7888	0.902 2195	0.902 2177	0.391 0617	0.391 1120
	24	0.041 0413	0.040 2626	0.901 6487	0.901 6469	0.390 7792	0.390 8643
	25	0.058 5005	0.057 7225	0.900 7981	0.900 7963	0.390 3753	0.390 4952
	26	0.075 9402	0.075 1632	0.899 6681	0.899 6663	0.389 8502	0.390 0048
	27	0.093 3553	0.092 5796	0.898 2593	0.898 2575	0.389 2043	0.389 3936
	28	+0.110 7406	+0.109 9664	-0.896 5722	-0.896 5704	-0.388 4377	-0.388 6616
	29	0.128 0910	0.127 3185	0.894 6074	0.894 6057	0.387 5508	0.387 8092
	30	0.145 4014	0.144 6309	0.892 3656	0.892 3639	0.386 5439	0.386 8368
	31	0.162 6667	0.161 8984	0.889 8476	0.889 8458	0.385 4173	0.385 7446
	32	+0.179 8819	+0.179 1161	-0.887 0539	-0.887 0522	-0.384 1715	-0.384 5331

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Date		Position Angle of Axis P	Heliographic Latitude B_0	Heliographic Longitude L_0	Date		Position Angle of Axis P	Heliographic Latitude B_0	Heliographic Longitude L_0
		°	°	°			°	°	°
Jan.	0	+2.81	-2.82	84.02	Feb.	15	-17.19	-6.80	198.32
	1	2.32	2.94	70.85		16	17.53	6.84	185.15
	2	1.84	3.06	57.68		17	17.86	6.89	171.98
	3	1.35	3.18	44.51		18	18.18	6.92	158.81
	4	0.87	3.29	31.34		19	18.50	6.96	145.64
	5	+0.38	3.40	18.17		20	18.81	7.00	132.48
	6	-0.10	-3.52	5.00		21	-19.12	-7.03	119.31
	7	0.58	3.63	351.83		22	19.42	7.06	106.14
	8	1.06	3.74	338.66		23	19.72	7.09	92.97
	9	1.55	3.85	325.49		24	20.01	7.11	79.80
	10	2.03	3.96	312.33		25	20.29	7.14	66.63
	11	2.50	4.07	299.16		26	20.57	7.16	53.46
	12	-2.98	-4.17	285.99		27	-20.84	-7.18	40.29
	13	3.45	4.28	272.82		28	21.10	7.20	27.12
	14	3.93	4.38	259.65		29	21.36	7.21	13.94
	15	4.40	4.48	246.48	Mar.	1	21.62	7.22	0.77
	16	4.87	4.58	233.32		2	21.86	7.23	347.60
	17	5.33	4.68	220.15		3	22.10	7.24	334.43
	18	-5.80	-4.78	206.98		4	-22.34	-7.25	321.25
	19	6.26	4.88	193.81		5	22.56	7.25	308.08
	20	6.71	4.97	180.65		6	22.78	7.25	294.90
	21	7.17	5.06	167.48		7	23.00	7.25	281.73
	22	7.62	5.16	154.31		8	23.20	7.25	268.55
	23	8.07	5.25	141.15		9	23.41	7.24	255.37
	24	-8.51	-5.33	127.98		10	-23.60	-7.24	242.20
	25	8.95	5.42	114.82		11	23.79	7.23	229.02
	26	9.39	5.50	101.65		12	23.97	7.21	215.84
	27	9.83	5.59	88.48		13	24.14	7.20	202.66
	28	10.25	5.67	75.32		14	24.31	7.18	189.48
	29	10.68	5.75	62.15		15	24.47	7.17	176.30
	30	-11.10	-5.83	48.99		16	-24.63	-7.15	163.12
	31	11.52	5.90	35.82		17	24.78	7.12	149.94
Feb.	1	11.93	5.98	22.65		18	24.92	7.10	136.76
	2	12.34	6.05	9.49		19	25.05	7.07	123.58
	3	12.74	6.12	356.32		20	25.18	7.04	110.39
	4	13.14	6.19	343.16		21	25.30	7.01	97.21
	5	-13.53	-6.25	329.99		22	-25.41	-6.98	84.02
	6	13.92	6.32	316.82		23	25.52	6.94	70.84
	7	14.31	6.38	303.66		24	25.62	6.90	57.65
	8	14.69	6.44	290.49		25	25.71	6.86	44.47
	9	15.06	6.50	277.32		26	25.79	6.82	31.28
	10	15.43	6.55	264.15		27	25.87	6.78	18.09
	11	-15.79	-6.61	250.99		28	-25.94	-6.73	4.90
	12	16.15	6.66	237.82		29	26.01	6.69	351.71
	13	16.50	6.71	224.65		30	26.07	6.64	338.52
	14	16.85	6.76	211.48		31	26.12	6.58	325.33
	15	-17.19	-6.80	198.32	Apr.	1	-26.16	-6.53	312.14

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Date		Position Angle of Axis P	Heliographic Latitude B_0	Heliographic Longitude L_0	Date		Position Angle of Axis P	Heliographic Latitude B_0	Heliographic Longitude L_0
		°	°	°			°	°	°
Apr.	1	-26.16	-6.53	312.14	May	17	-20.28	-2.41	64.45
	2	26.19	6.48	298.95		18	19.99	2.30	51.22
	3	26.22	6.42	285.75		19	19.69	2.18	37.99
	4	26.24	6.36	272.56		20	19.38	2.06	24.77
	5	26.26	6.30	259.36		21	19.07	1.95	11.54
	6	26.26	6.24	246.17		22	18.75	-1.83	358.31
	7	-26.26	-6.17	232.97		23	-18.43	-1.71	345.08
	8	26.26	6.11	219.77		24	18.10	1.59	331.85
	9	26.24	6.04	206.57		25	17.77	1.48	318.62
	10	26.22	5.97	193.37		26	17.42	1.36	305.39
	11	26.19	5.90	180.17		27	17.08	1.24	292.16
	12	26.15	5.82	166.97		28	16.73	1.12	278.93
	13	-26.11	-5.75	153.77		29	-16.37	-1.00	265.69
	14	26.05	5.67	140.57		30	16.01	0.88	252.46
	15	26.00	5.59	127.36		31	15.64	0.76	239.23
	16	25.93	5.51	114.16	June	1	15.27	0.64	225.99
	17	25.85	5.43	100.95		2	14.89	0.52	212.76
	18	25.77	5.35	87.75		3	14.51	0.40	199.53
	19	-25.68	-5.26	74.54		4	-14.12	-0.28	186.29
	20	25.59	5.18	61.33		5	13.73	0.15	173.06
	21	25.49	5.09	48.13		6	13.34	-0.03	159.82
	22	25.37	5.00	34.92		7	12.94	+0.09	146.58
	23	25.26	4.91	21.71		8	12.54	0.21	133.35
	24	25.13	4.82	8.50		9	12.13	0.33	120.11
	25	-25.00	-4.73	355.29		10	-11.72	+0.45	106.88
	26	24.86	4.63	342.07		11	11.31	0.57	93.64
	27	24.71	4.54	328.86		12	10.89	0.69	80.40
	28	24.56	4.44	315.65		13	10.47	0.81	67.17
	29	24.39	4.34	302.43		14	10.04	0.93	53.93
	30	24.23	4.25	289.22		15	9.62	1.05	40.70
May	1	-24.05	-4.15	276.00		16	-9.19	+1.17	27.46
	2	23.87	4.04	262.79		17	8.75	1.29	14.22
	3	23.68	3.94	249.57		18	8.32	1.41	0.99
	4	23.48	3.84	236.35		19	7.88	1.52	347.75
	5	23.27	3.73	223.13		20	7.44	1.64	334.51
	6	23.06	3.63	209.91		21	7.00	1.76	321.28
	7	-22.84	-3.52	196.69		22	-6.55	+1.87	308.04
	8	22.62	3.42	183.47		23	6.11	1.99	294.80
	9	22.38	3.31	170.25		24	5.66	2.11	281.57
	10	22.14	3.20	157.02		25	5.21	2.22	268.33
	11	21.90	3.09	143.80		26	4.76	2.34	255.09
	12	21.64	2.98	130.58		27	4.31	2.45	241.86
	13	-21.38	-2.87	117.35		28	-3.86	+2.56	228.62
	14	21.12	2.75	104.13		29	3.41	2.67	215.38
	15	20.84	2.64	90.90		30	2.96	2.79	202.15
	16	20.56	2.53	77.68	July	1	2.50	2.90	188.91
	17	-20.28	-2.41	64.45		2	-2.05	+3.01	175.67

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Date		Position Angle of Axis P	Heliographic Latitude B_0	Heliographic Longitude L_0	Date		Position Angle of Axis P	Heliographic Latitude B_0	Heliographic Longitude L_0
		°	°	°			°	°	°
July	1	-2.50	+2.90	188.91	Aug.	16	+16.45	+6.70	300.39
	2	2.05	3.01	175.67		17	16.78	6.75	287.18
	3	1.60	3.12	162.44		18	17.11	6.79	273.96
	4	1.14	3.22	149.20		19	17.43	6.83	260.74
	5	0.69	3.33	135.97		20	17.75	6.87	247.53
	6	-0.24	3.44	122.73		21	18.06	6.91	234.31
	7	+0.21	+3.54	109.49		22	+18.37	+6.95	221.10
	8	0.67	3.65	96.26		23	18.67	6.98	207.88
	9	1.12	3.75	83.02		24	18.96	7.01	194.67
	10	1.57	3.86	69.79		25	19.26	7.04	181.46
	11	2.01	3.96	56.55		26	19.54	7.07	168.24
	12	2.46	4.06	43.32		27	19.82	7.10	155.03
	13	+2.91	+4.16	30.09		28	+20.10	+7.12	141.82
	14	3.35	4.25	16.85		29	20.37	7.14	128.61
	15	3.80	4.35	3.62		30	20.63	7.16	115.40
	16	4.24	4.45	350.39		31	20.89	7.18	102.19
	17	4.68	4.54	337.16	Sept.	1	21.15	7.20	88.98
	18	5.12	4.64	323.93		2	21.40	7.21	75.77
	19	+5.55	+4.73	310.69		3	+21.64	+7.22	62.56
	20	5.98	4.82	297.46		4	21.88	7.23	49.35
	21	6.42	4.91	284.23		5	22.11	7.24	36.14
	22	6.84	5.00	271.00		6	22.33	7.25	22.94
	23	7.27	5.08	257.77		7	22.55	7.25	9.73
	24	7.69	5.17	244.54		8	22.77	7.25	356.52
	25	+8.11	+5.25	231.32		9	+22.97	+7.25	343.32
	26	8.53	5.34	218.09		10	23.18	7.25	330.11
	27	8.94	5.42	204.86		11	23.37	7.24	316.91
	28	9.35	5.50	191.63		12	23.56	7.24	303.70
	29	9.76	5.58	178.40		13	23.75	7.23	290.50
	30	10.17	5.65	165.18		14	23.93	7.22	277.30
	31	+10.57	+5.73	151.95		15	+24.10	+7.20	264.10
Aug.	1	10.97	5.80	138.72		16	24.26	7.19	250.89
	2	11.36	5.87	125.50		17	24.42	7.17	237.69
	3	11.75	5.94	112.27		18	24.58	7.15	224.49
	4	12.14	6.01	99.05		19	24.73	7.13	211.29
	5	12.52	6.08	85.82		20	24.87	7.11	198.09
	6	+12.90	+6.14	72.60		21	+25.00	+7.08	184.89
	7	13.27	6.21	59.38		22	25.13	7.05	171.69
	8	13.64	6.27	46.15		23	25.25	7.02	158.49
	9	14.01	6.33	32.93		24	25.36	6.99	145.30
	10	14.37	6.39	19.71		25	25.47	6.96	132.10
	11	14.73	6.44	6.49		26	25.57	6.92	118.90
	12	+15.08	+6.50	353.27		27	+25.67	+6.88	105.70
	13	15.43	6.55	340.05		28	25.75	6.84	92.50
	14	15.78	6.60	326.83		29	25.84	6.80	79.31
	15	16.12	6.65	313.61		30	25.91	6.76	66.11
	16	+16.45	+6.70	300.39	Oct.	1	+25.98	+6.71	52.92

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		°	°	°			°	°	°
Oct.	1	+25.98	+6.71	52.92	Nov.	16	+21.00	+2.70	166.24
	2	26.04	6.66	39.72		17	20.71	2.59	153.06
	3	26.09	6.61	26.52		18	20.41	2.47	139.87
	4	26.14	6.56	13.33		19	20.11	2.35	126.69
	5	26.18	6.51	0.13		20	19.80	2.23	113.51
	6	26.21	6.45	346.94		21	19.48	2.10	100.33
	7	+26.23	+6.39	333.75		22	+19.16	+1.98	87.15
	8	26.25	6.33	320.55		23	18.83	1.86	73.97
	9	26.26	6.27	307.36		24	18.49	1.73	60.79
	10	26.26	6.20	294.17		25	18.14	1.61	47.61
	11	26.26	6.14	280.97		26	17.79	1.49	34.43
	12	26.25	6.07	267.78		27	17.43	1.36	21.25
	13	+26.23	+6.00	254.59		28	+17.07	+1.23	8.07
	14	26.20	5.93	241.40		29	16.70	1.11	354.89
	15	26.17	5.86	228.21		30	16.32	0.98	341.71
	16	26.13	5.78	215.02	Dec.	1	15.94	0.85	328.53
	17	26.08	5.71	201.83		2	15.55	0.73	315.35
	18	26.02	5.63	188.64		3	15.15	0.60	302.17
	19	+25.96	+5.55	175.45		4	+14.75	+0.47	288.99
	20	25.88	5.46	162.26		5	14.34	0.34	275.81
	21	25.80	5.38	149.07		6	13.93	0.22	262.64
	22	25.72	5.30	135.88		7	13.52	+0.09	249.46
	23	25.62	5.21	122.69		8	13.09	-0.04	236.28
	24	25.52	5.12	109.50		9	12.67	0.17	223.10
	25	+25.41	+5.03	96.32		10	+12.24	-0.30	209.93
	26	25.29	4.94	83.13		11	11.80	0.42	196.75
	27	25.16	4.85	69.94		12	11.36	0.55	183.58
	28	25.03	4.75	56.75		13	10.92	0.68	170.40
	29	24.89	4.66	43.57		14	10.47	0.81	157.23
	30	24.74	4.56	30.38		15	10.02	0.94	144.05
	31	+24.58	+4.46	17.19		16	+9.56	-1.06	130.88
Nov.	1	24.42	4.36	4.00		17	9.10	1.19	117.70
	2	24.24	4.26	350.82		18	8.64	1.32	104.53
	3	24.06	4.15	337.63		19	8.18	1.44	91.35
	4	23.87	4.05	324.45		20	7.71	1.57	78.18
	5	23.68	3.94	311.26		21	7.24	1.69	65.01
	6	+23.47	+3.84	298.07		22	+6.77	-1.82	51.83
	7	23.26	3.73	284.89		23	6.29	1.94	38.66
	8	23.04	3.62	271.70		24	5.81	2.07	25.49
	9	22.81	3.51	258.52		25	5.34	2.19	12.32
	10	22.57	3.40	245.34		26	4.86	2.31	359.14
	11	22.33	3.28	232.15		27	4.38	2.43	345.97
	12	+22.08	+3.17	218.97		28	+3.89	-2.55	332.80
	13	21.82	3.05	205.79		29	3.41	2.67	319.63
	14	21.55	2.94	192.60		30	2.93	2.79	306.46
	15	21.28	2.82	179.42		31	2.44	2.91	293.29
	16	+21.00	+2.70	166.24		32	+1.96	-3.03	280.11

MOON, 2020

UNIVERSAL TIME

PHASES OF THE MOON

Lunation	New Moon	d	h	m	First Quarter	d	h	m	Full Moon	d	h	m	Last Quarter	d	h	m
1201	Dec.	26	05	13	Jan.	3	04	45	Jan.	10	19	21	Jan.	17	12	58
1202	Jan.	24	21	42	Feb.	2	01	42	Feb.	9	07	33	Feb.	15	22	17
1203	Feb.	23	15	32	Mar.	2	19	57	Mar.	9	17	48	Mar.	16	09	34
1204	Mar.	24	09	28	Apr.	1	10	21	Apr.	8	02	35	Apr.	14	22	56
1205	Apr.	23	02	26	Apr.	30	20	38	May	7	10	45	May	14	14	03
1206	May	22	17	39	May	30	03	30	Jun.	5	19	12	Jun.	13	06	24
1207	Jun.	21	06	41	Jun.	28	08	16	Jul.	5	04	44	Jul.	12	23	29
1208	Jul.	20	17	33	Jul.	27	12	33	Aug.	3	15	59	Aug.	11	16	45
1209	Aug.	19	02	42	Aug.	25	17	58	Sep.	2	05	22	Sep.	10	09	26
1210	Sep.	17	11	00	Sep.	24	01	55	Oct.	1	21	05	Oct.	10	00	40
1211	Oct.	16	19	31	Oct.	23	13	23	Oct.	31	14	49	Nov.	8	13	46
1212	Nov.	15	05	07	Nov.	22	04	45	Nov.	30	09	30	Dec.	8	00	37
1213	Dec.	14	16	17	Dec.	21	23	41	Dec.	30	03	28	Jan.	6	09	37

MOON AT PERIGEE

	d	h		d	h		d	h
Dec.	18	20	May	6	03	Sep.	18	14
Jan.	13	20	Jun.	3	04	Oct.	16	24
Feb.	10	20	Jun.	30	02	Nov.	14	12
Mar.	10	07	Jul.	25	05	Dec.	12	21
Apr.	7	18	Aug.	21	11	Jan.	9	16

MOON AT APOGEE

	d	h		d	h		d	h
Dec.	5	04	Apr.	20	19	Sep.	6	06
Jan.	2	02	May	18	08	Oct.	3	17
Jan.	29	21	Jun.	15	01	Oct.	30	19
Feb.	26	12	Jul.	12	19	Nov.	27	00
Mar.	24	15	Aug.	9	14	Dec.	24	17
						Jan.	21	13

MOON, 2020
MEAN EQUATOR, ORBIT, LONGITUDE AND ELONGATION

Date		Mean Equator i	Mean Equator Δ	Mean Equator Ω'	Orbit Perigee Γ'	Node Ω	Mean Longitude ☾	Mean Elongation D
		°	°	°	° ' "	° ' "	° ' "	°
Jan.	**1**	23.704	281.722	356.200	177 05 59.5	98 14 37.9	345 18 16.7	65.177
	11	23.690	281.200	356.193	178 12 50.0	97 42 51.6	117 04 06.9	187.085
	21	23.676	280.676	356.186	179 19 40.5	97 11 05.2	248 49 57.2	308.992
	31	23.662	280.153	356.180	180 26 31.0	96 39 18.9	20 35 47.5	70.900
Feb.	**10**	23.648	279.629	356.174	181 33 21.6	96 07 32.6	152 21 37.7	192.807
	20	23.634	279.105	356.168	182 40 12.1	95 35 46.2	284 07 28.0	314.714
Mar.	**1**	23.620	278.581	356.162	183 47 02.6	95 03 59.9	55 53 18.3	76.622
	11	23.606	278.056	356.157	184 53 53.1	94 32 13.6	187 39 08.6	198.529
	21	23.591	277.531	356.152	186 00 43.7	94 00 27.2	319 24 58.8	320.437
	31	23.577	277.006	356.148	187 07 34.2	93 28 40.9	91 10 49.1	82.344
Apr.	**10**	23.563	276.481	356.144	188 14 24.7	92 56 54.6	222 56 39.4	204.252
	20	23.549	275.955	356.140	189 21 15.2	92 25 08.2	354 42 29.7	326.159
	30	23.535	275.429	356.136	190 28 05.8	91 53 21.9	126 28 19.9	88.067
May	**10**	23.521	274.902	356.133	191 34 56.3	91 21 35.6	258 14 10.2	209.974
	20	23.506	274.376	356.130	192 41 46.8	90 49 49.2	30 00 00.5	331.882
	30	23.492	273.848	356.128	193 48 37.3	90 18 02.9	161 45 50.7	93.789
June	**9**	23.478	273.321	356.125	194 55 27.8	89 46 16.5	293 31 41.0	215.697
	19	23.464	272.794	356.123	196 02 18.4	89 14 30.2	65 17 31.3	337.604
	29	23.450	272.266	356.122	197 09 08.9	88 42 43.9	197 03 21.6	99.512
July	**9**	23.436	271.737	356.121	198 15 59.4	88 10 57.5	328 49 11.8	221.419
	19	23.421	271.209	356.120	199 22 49.9	87 39 11.2	100 35 02.1	343.327
	29	23.407	270.680	356.119	200 29 40.5	87 07 24.9	232 20 52.4	105.234
Aug.	**8**	23.393	270.151	356.119	201 36 31.0	86 35 38.5	4 06 42.7	227.142
	18	23.379	269.621	356.119	202 43 21.5	86 03 52.2	135 52 32.9	349.049
	28	23.365	269.092	356.119	203 50 12.0	85 32 05.9	267 38 23.2	110.957
Sept.	**7**	23.350	268.562	356.120	204 57 02.5	85 00 19.5	39 24 13.5	232.864
	17	23.336	268.031	356.121	206 03 53.1	84 28 33.2	171 10 03.7	354.772
	27	23.322	267.501	356.123	207 10 43.6	83 56 46.9	302 55 54.0	116.679
Oct.	**7**	23.308	266.970	356.124	208 17 34.1	83 25 00.5	74 41 44.3	238.587
	17	23.293	266.439	356.126	209 24 24.6	82 53 14.2	206 27 34.6	0.494
	27	23.279	265.907	356.129	210 31 15.2	82 21 27.9	338 13 24.8	122.402
Nov.	**6**	23.265	265.375	356.132	211 38 05.7	81 49 41.5	109 59 15.1	244.309
	16	23.251	264.843	356.135	212 44 56.2	81 17 55.2	241 45 05.4	6.217
	26	23.236	264.311	356.138	213 51 46.7	80 46 08.9	13 30 55.7	128.124
Dec.	**6**	23.222	263.778	356.142	214 58 37.3	80 14 22.5	145 16 45.9	250.032
	16	23.208	263.245	356.146	216 05 27.8	79 42 36.2	277 02 36.2	11.939
	26	23.194	262.712	356.150	217 12 18.3	79 10 49.9	48 48 26.5	133.847
	36	23.179	262.178	356.155	218 19 08.8	78 39 03.5	180 34 16.7	255.754
	46	23.165	261.644	356.160	219 25 59.3	78 07 17.2	312 20 07.0	17.662

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Jan.	0.0	334	09	53.3	-4	22	27.7	2.6870	14	51.54
	0.5	340	09	41.7	4	39	36.2	2.6942	14	49.14
	1.0	346	07	43.9	4	53	37.5	2.6996	14	47.35
	1.5	352	04	30.8	5	04	26.3	2.7031	14	46.22
	2.0	358	00	35.3	5	11	58.6	2.7044	14	45.78
	2.5	3	56	31.7	5	16	11.1	2.7036	14	46.05
	3.0	9	52	55.1	-5	17	01.5	2.7006	14	47.04
	3.5	15	50	21.3	5	14	28.0	2.6954	14	48.76
	4.0	21	49	26.0	5	08	29.6	2.6880	14	51.20
	4.5	27	50	44.6	4	59	06.4	2.6786	14	54.33
	5.0	33	54	51.4	4	46	19.2	2.6672	14	58.13
	5.5	40	02	19.2	4	30	10.2	2.6542	15	02.55
	6.0	46	13	38.8	-4	10	43.2	2.6396	15	07.53
	6.5	52	29	18.0	3	48	04.0	2.6238	15	13.00
	7.0	58	49	41.0	3	22	20.9	2.6070	15	18.87
	7.5	65	15	08.0	2	53	45.1	2.5896	15	25.04
	8.0	71	45	54.1	2	22	31.2	2.5720	15	31.40
	8.5	78	22	08.8	1	48	57.7	2.5544	15	37.82
	9.0	85	03	55.5	-1	13	26.9	2.5372	15	44.17
	9.5	91	51	10.7	-0	36	25.6	2.5207	15	50.33
	10.0	98	43	44.0	+0	01	35.5	2.5054	15	56.15
	10.5	105	41	18.1	0	40	01.9	2.4914	16	01.52
	11.0	112	43	28.5	1	18	16.2	2.4791	16	06.31
	11.5	119	49	44.6	1	55	38.8	2.4685	16	10.42
	12.0	126	59	30.2	+2	31	29.4	2.4600	16	13.80
	12.5	134	12	04.4	3	05	08.2	2.4535	16	16.37
	13.0	141	26	43.4	3	35	57.2	2.4491	16	18.13
	13.5	148	42	41.8	4	03	21.7	2.4467	16	19.07
	14.0	155	59	13.8	4	26	51.7	2.4464	16	19.22
	14.5	163	15	35.5	4	46	02.4	2.4478	16	18.63
	15.0	170	31	05.4	+5	00	35.2	2.4510	16	17.38
	15.5	177	45	06.5	5	10	17.8	2.4556	16	15.54
	16.0	184	57	06.1	5	15	04.3	2.4615	16	13.20
	16.5	192	06	37.1	5	14	54.7	2.4685	16	10.43
	17.0	199	13	18.0	5	09	54.8	2.4764	16	07.33
	17.5	206	16	52.4	5	00	15.3	2.4851	16	03.97
	18.0	213	17	09.0	+4	46	11.2	2.4943	16	00.41
	18.5	220	14	00.9	4	28	01.2	2.5039	15	56.71
	19.0	227	07	24.7	4	06	07.2	2.5139	15	52.91
	19.5	233	57	20.1	3	40	53.4	2.5241	15	49.04
	20.0	240	43	48.7	3	12	46.0	2.5346	15	45.13
	20.5	247	26	53.7	2	42	12.6	2.5452	15	41.20
	21.0	254	06	39.0	+2	09	41.9	2.5559	15	37.24
	21.5	260	43	08.9	1	35	42.9	2.5668	15	33.27
	22.0	267	16	27.5	1	00	45.0	2.5778	15	29.30
	22.5	273	46	38.7	+0	25	17.3	2.5889	15	25.32
	23.0	280	13	46.2	-0	10	11.8	2.6000	15	21.35

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Jan.	23.0	280	13	46.2	-0	10	11.8	2.6000	15	21.35
	23.5	286	37	53.2	0	45	15.0	2.6112	15	17.41
	24.0	292	59	02.8	1	19	26.3	2.6223	15	13.51
	24.5	299	17	18.1	1	52	21.5	2.6334	15	09.67
	25.0	305	32	42.8	2	23	38.3	2.6443	15	05.94
	25.5	311	45	21.1	2	52	56.6	2.6548	15	02.34
	26.0	317	55	18.5	-3	19	58.7	2.6649	14	58.91
	26.5	324	02	42.1	3	44	29.2	2.6744	14	55.72
	27.0	330	07	40.5	4	06	15.1	2.6832	14	52.80
	27.5	336	10	24.8	4	25	05.9	2.6910	14	50.21
	28.0	342	11	08.2	4	40	53.0	2.6977	14	48.00
	28.5	348	10	06.7	4	53	30.0	2.7031	14	46.22
	29.0	354	07	38.8	-5	02	52.2	2.7070	14	44.94
	29.5	0	04	05.9	5	08	56.5	2.7093	14	44.18
	30.0	5	59	51.9	5	11	41.2	2.7098	14	44.01
	30.5	11	55	23.6	5	11	05.6	2.7085	14	44.45
	31.0	17	51	09.9	5	07	10.4	2.7051	14	45.55
	31.5	23	47	42.2	4	59	56.8	2.6997	14	47.33
Feb.	1.0	29	45	33.8	-4	49	27.2	2.6922	14	49.80
	1.5	35	45	19.7	4	35	44.7	2.6827	14	52.97
	2.0	41	47	35.9	4	18	53.4	2.6711	14	56.84
	2.5	47	52	59.3	3	58	58.6	2.6576	15	01.40
	3.0	54	02	06.6	3	36	07.0	2.6423	15	06.61
	3.5	60	15	34.2	3	10	26.9	2.6254	15	12.44
	4.0	66	33	56.6	-2	42	08.8	2.6072	15	18.81
	4.5	72	57	46.1	2	11	25.8	2.5880	15	25.64
	5.0	79	27	31.4	1	38	33.9	2.5680	15	32.85
	5.5	86	03	36.3	1	03	52.8	2.5476	15	40.30
	6.0	92	46	18.5	-0	27	45.9	2.5273	15	47.85
	6.5	99	35	48.3	+0	09	19.3	2.5074	15	55.37
	7.0	106	32	07.2	+0	46	50.9	2.4884	16	02.66
	7.5	113	35	06.6	1	24	13.2	2.4707	16	09.56
	8.0	120	44	27.3	2	00	47.2	2.4547	16	15.90
	8.5	127	59	38.7	2	35	51.5	2.4407	16	21.50
	9.0	135	19	59.0	3	08	43.9	2.4290	16	26.20
	9.5	142	44	36.1	3	38	42.7	2.4200	16	29.90
	10.0	150	12	29.1	+4	05	09.1	2.4137	16	32.48
	10.5	157	42	30.3	4	27	28.3	2.4102	16	33.90
	11.0	165	13	28.2	4	45	12.1	2.4097	16	34.14
	11.5	172	44	10.6	4	57	59.5	2.4118	16	33.24
	12.0	180	13	27.5	5	05	37.6	2.4167	16	31.26
	12.5	187	40	14.4	5	08	02.2	2.4239	16	28.31
	13.0	195	03	34.4	+5	05	17.1	2.4332	16	24.51
	13.5	202	22	40.3	4	57	33.2	2.4444	16	20.00
	14.0	209	36	55.3	4	45	07.7	2.4571	16	14.94
	14.5	216	45	53.4	4	28	23.0	2.4710	16	09.47
	15.0	223	49	19.1	+4	07	44.6	2.4857	16	03.73

MOON, 2020
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Feb.	15.0	223	49	19.1	+4	07	44.6	2.4857	16	03.73
	15.5	230	47	06.5	3	43	40.7	2.5010	15	57.84
	16.0	237	39	17.8	3	16	40.8	2.5165	15	51.92
	16.5	244	26	02.1	2	47	15.0	2.5321	15	46.05
	17.0	251	07	33.7	2	15	53.1	2.5476	15	40.31
	17.5	257	44	10.7	1	43	04.5	2.5627	15	34.77
	18.0	264	16	13.7	+1	09	17.7	2.5774	15	29.45
	18.5	270	44	04.5	0	35	00.0	2.5915	15	24.39
	19.0	277	08	05.0	+0	00	37.6	2.6049	15	19.61
	19.5	283	28	36.6	-0	33	24.6	2.6178	15	15.10
	20.0	289	45	59.5	1	06	43.1	2.6299	15	10.89
	20.5	296	00	32.2	1	38	55.7	2.6413	15	06.95
	21.0	302	12	31.4	-2	09	41.7	2.6520	15	03.29
	21.5	308	22	11.8	2	38	42.1	2.6620	14	59.89
	22.0	314	29	46.2	3	05	39.3	2.6713	14	56.77
	22.5	320	35	25.9	3	30	17.5	2.6798	14	53.91
	23.0	326	39	20.7	3	52	22.9	2.6876	14	51.33
	23.5	332	41	39.4	4	11	43.5	2.6946	14	49.02
	24.0	338	42	30.4	-4	28	09.0	2.7007	14	47.00
	24.5	344	42	02.1	4	41	31.3	2.7059	14	45.30
	25.0	350	40	23.1	4	51	44.3	2.7101	14	43.92
	25.5	356	37	43.3	4	58	43.5	2.7132	14	42.90
	26.0	2	34	13.9	5	02	26.5	2.7152	14	42.28
	26.5	8	30	07.9	5	02	52.3	2.7158	14	42.07
	27.0	14	25	40.6	-5	00	01.7	2.7150	14	42.32
	27.5	20	21	09.7	4	53	56.8	2.7128	14	43.06
	28.0	26	16	55.5	4	44	40.9	2.7089	14	44.33
	28.5	32	13	21.3	4	32	18.8	2.7033	14	46.15
	29.0	38	10	53.2	4	16	56.0	2.6959	14	48.57
	29.5	44	09	59.7	3	58	39.3	2.6868	14	51.59
Mar.	1.0	50	11	12.4	-3	37	36.7	2.6758	14	55.24
	1.5	56	15	04.7	3	13	57.2	2.6631	14	59.54
	2.0	62	22	12.1	2	47	51.1	2.6486	15	04.46
	2.5	68	33	11.5	2	19	30.3	2.6324	15	10.01
	3.0	74	48	40.3	1	49	08.5	2.6147	15	16.16
	3.5	81	09	15.7	-1	17	01.5	2.5958	15	22.85
	4.0	87	35	33.6	+0	43	27.5	2.5758	15	30.03
	4.5	94	08	07.3	0	08	47.8	2.5550	15	37.60
	5.0	100	47	26.1	0	26	33.4	2.5337	15	45.45
	5.5	107	33	53.4	1	02	08.3	2.5124	15	53.46
	6.0	114	27	45.1	1	37	25.5	2.4915	16	01.47
	6.5	121	29	07.6	2	11	50.4	2.4714	16	09.31
	7.0	128	37	55.9	+2	44	45.6	2.4525	16	16.77
	7.5	135	53	52.4	3	15	31.4	2.4353	16	23.67
	8.0	143	16	25.1	3	43	27.8	2.4202	16	29.81
	8.5	150	44	48.0	4	07	55.3	2.4076	16	34.98
	9.0	158	18	01.3	+4	28	17.7	2.3978	16	39.03

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Mar.	9.0	158	18	01.3	+4	28	17.7	2.3978	16	39.03
	9.5	165	54	53.1	4	44	03.5	2.3912	16	41.83
	10.0	173	34	01.8	4	54	48.2	2.3877	16	43.28
	10.5	181	14	00.3	5	00	15.6	2.3876	16	43.34
	11.0	188	53	19.4	5	00	18.8	2.3907	16	42.02
	11.5	196	30	32.7	4	55	01.0	2.3970	16	39.40
	12.0	204	04	20.6	+4	44	34.1	2.4062	16	35.57
	12.5	211	33	33.2	4	29	18.4	2.4180	16	30.70
	13.0	218	57	13.5	4	09	40.8	2.4322	16	24.94
	13.5	226	14	38.1	3	46	12.6	2.4482	16	18.49
	14.0	233	25	17.7	3	19	28.5	2.4657	16	11.53
	14.5	240	28	56.6	2	50	04.2	2.4843	16	04.26
	15.0	247	25	31.5	+2	18	35.3	2.5036	15	56.84
	15.5	254	15	09.4	1	45	36.3	2.5232	15	49.42
	16.0	260	58	05.9	1	11	39.8	2.5427	15	42.14
	16.5	267	34	43.5	0	37	16.4	2.5618	15	35.10
	17.0	274	05	29.2	+0	02	53.9	2.5803	15	28.39
	17.5	280	30	53.3	-0	31	02.2	2.5980	15	22.07
	18.0	286	51	27.5	-1	04	08.6	2.6147	15	16.19
	18.5	293	07	44.2	1	36	04.4	2.6302	15	10.78
	19.0	299	20	15.0	2	06	30.6	2.6445	15	05.86
	19.5	305	29	30.2	2	35	09.9	2.6575	15	01.42
	20.0	311	35	58.2	3	01	46.7	2.6692	14	57.47
	20.5	317	40	05.0	3	26	07.1	2.6796	14	54.00
	21.0	323	42	14.2	-3	47	58.4	2.6886	14	50.98
	21.5	329	42	46.6	4	07	09.4	2.6965	14	48.40
	22.0	335	42	00.7	4	23	30.6	2.7030	14	46.24
	22.5	341	40	12.2	4	36	53.6	2.7084	14	44.48
	23.0	347	37	35.0	4	47	11.9	2.7126	14	43.11
	23.5	353	34	21.0	4	54	20.3	2.7157	14	42.10
	24.0	359	30	41.0	-4	58	15.4	2.7177	14	41.47
	24.5	5	26	44.6	4	58	55.3	2.7185	14	41.19
	25.0	11	22	41.4	4	56	20.0	2.7183	14	41.26
	25.5	17	18	40.9	4	50	31.1	2.7169	14	41.71
	26.0	23	14	53.6	4	41	31.9	2.7144	14	42.52
	26.5	29	11	31.0	4	29	27.2	2.7107	14	43.71
	27.0	35	08	46.3	-4	14	23.5	2.7058	14	45.31
	27.5	41	06	54.7	3	56	28.5	2.6997	14	47.34
	28.0	47	06	14.1	3	35	51.7	2.6922	14	49.80
	28.5	53	07	04.5	3	12	43.7	2.6834	14	52.73
	29.0	59	09	48.8	2	47	16.3	2.6732	14	56.14
	29.5	65	14	52.6	2	19	42.9	2.6615	15	00.06
	30.0	71	22	44.1	-1	50	18.0	2.6485	15	04.48
	30.5	77	33	53.5	1	19	17.8	2.6341	15	09.42
	31.0	83	48	53.1	0	46	59.8	2.6184	15	14.88
	31.5	90	08	16.1	-0	13	43.5	2.6015	15	20.82
Apr.	1.0	96	32	36.3	+0	20	10.0	2.5835	15	27.23

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Apr.	1.0	96	32	36.3	+0	20	10.0	2.5835	15	27.23
	1.5	103	02	26.9	0	54	17.1	2.5647	15	34.05
	2.0	109	38	18.8	1	28	12.2	2.5451	15	41.22
	2.5	116	20	40.0	2	01	27.2	2.5252	15	48.65
	3.0	123	09	52.8	2	33	31.7	2.5052	15	56.21
	3.5	130	06	13.0	3	03	53.1	2.4855	16	03.79
	4.0	137	09	47.0	+3	31	57.0	2.4665	16	11.22
	4.5	144	20	30.6	3	57	08.4	2.4486	16	18.33
	5.0	151	38	06.9	4	18	52.3	2.4322	16	24.93
	5.5	159	02	05.1	4	36	35.3	2.4177	16	30.83
	6.0	166	31	40.4	4	49	47.5	2.4055	16	35.83
	6.5	174	05	53.9	4	58	04.0	2.3961	16	39.77
	7.0	181	43	34.5	+5	01	06.9	2.3896	16	42.50
	7.5	189	23	21.3	4	58	46.6	2.3862	16	43.90
	8.0	197	03	47.2	4	51	03.0	2.3862	16	43.92
	8.5	204	43	22.9	4	38	05.6	2.3894	16	42.55
	9.0	212	20	41.2	4	20	13.5	2.3960	16	39.82
	9.5	219	54	21.4	3	57	53.4	2.4056	16	35.82
	10.0	227	23	12.4	+3	31	39.1	2.4180	16	30.71
	10.5	234	46	15.4	3	02	08.6	2.4329	16	24.63
	11.0	242	02	45.6	2	30	02.3	2.4499	16	17.79
	11.5	249	12	12.2	1	56	01.3	2.4686	16	10.38
	12.0	256	14	18.2	1	20	45.4	2.4886	16	02.60
	12.5	263	08	59.1	0	44	52.2	2.5094	15	54.64
	13.0	269	56	21.6	+0	08	56.3	2.5305	15	46.67
	13.5	276	36	41.2	-0	26	31.3	2.5516	15	38.85
	14.0	283	10	21.1	1	01	03.5	2.5723	15	31.30
	14.5	289	37	49.6	1	34	16.5	2.5922	15	24.13
	15.0	295	59	38.9	2	05	49.6	2.6112	15	17.42
	15.5	302	16	23.5	2	35	25.3	2.6289	15	11.24
	16.0	308	28	39.0	-3	02	48.6	2.6451	15	05.64
	16.5	314	37	01.3	3	27	46.5	2.6598	15	00.63
	17.0	320	42	05.2	3	50	08.1	2.6729	14	56.24
	17.5	326	44	24.3	4	09	43.8	2.6842	14	52.46
	18.0	332	44	30.2	4	26	25.5	2.6938	14	49.28
	18.5	338	42	52.4	4	40	06.6	2.7016	14	46.70
	19.0	344	39	57.8	-4	50	41.4	2.7078	14	44.68
	19.5	350	36	10.8	4	58	05.4	2.7123	14	43.20
	20.0	356	31	53.1	5	02	15.6	2.7153	14	42.23
	20.5	2	27	24.0	5	03	09.8	2.7168	14	41.74
	21.0	8	23	00.4	5	00	47.6	2.7169	14	41.71
	21.5	14	18	57.1	4	55	09.8	2.7157	14	42.09
	22.0	20	15	27.3	-4	46	18.9	2.7134	14	42.86
	22.5	26	12	42.4	4	34	18.9	2.7099	14	44.01
	23.0	32	10	53.3	4	19	15.7	2.7053	14	45.50
	23.5	38	10	10.1	4	01	16.7	2.6997	14	47.32
	24.0	44	10	42.9	-3	40	31.5	2.6932	14	49.46

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Apr.	24.0	44	10	42.9	-3	40	31.5	2.6932	14	49.46
	24.5	50	12	42.4	3	17	11.0	2.6858	14	51.92
	25.0	56	16	19.9	2	51	28.1	2.6775	14	54.68
	25.5	62	21	48.2	2	23	37.5	2.6683	14	57.76
	26.0	68	29	21.3	1	53	55.2	2.6583	15	01.15
	26.5	74	39	15.3	1	22	39.0	2.6474	15	04.85
	27.0	80	51	48.2	-0	50	08.1	2.6357	15	08.88
	27.5	87	07	19.5	-0	16	43.1	2.6231	15	13.24
	28.0	93	26	10.9	+0	17	14.1	2.6097	15	17.93
	28.5	99	48	45.1	0	51	20.0	2.5955	15	22.95
	29.0	106	15	25.9	1	25	10.1	2.5806	15	28.28
	29.5	112	46	37.3	1	58	18.2	2.5651	15	33.90
	30.0	119	22	42.6	+2	30	17.3	2.5490	15	39.77
	30.5	126	04	03.3	3	00	39.1	2.5327	15	45.86
May	1.0	132	50	58.1	3	28	54.3	2.5161	15	52.08
	1.5	139	43	41.0	3	54	33.2	2.4996	15	58.36
	2.0	146	42	20.1	4	17	05.9	2.4835	16	04.59
	2.5	153	46	56.3	4	36	03.4	2.4679	16	10.66
	3.0	160	57	21.1	+4	50	58.1	2.4534	16	16.43
	3.5	168	13	16.2	5	01	25.0	2.4401	16	21.74
	4.0	175	34	12.4	5	07	03.3	2.4284	16	26.46
	4.5	182	59	29.1	5	07	37.5	2.4187	16	30.41
	5.0	190	28	15.3	5	02	58.6	2.4113	16	33.46
	5.5	197	59	30.6	4	53	05.3	2.4064	16	35.49
	6.0	205	32	07.0	+4	38	04.9	2.4042	16	36.38
	6.5	213	04	52.2	4	18	13.1	2.4049	16	36.08
	7.0	220	36	31.8	3	53	53.8	2.4086	16	34.57
	7.5	228	05	53.6	3	25	38.4	2.4152	16	31.87
	8.0	235	31	49.6	2	54	03.6	2.4245	16	28.04
	8.5	242	53	19.6	2	19	50.5	2.4365	16	23.19
	9.0	250	09	32.6	+1	43	41.9	2.4508	16	17.45
	9.5	257	19	48.6	1	06	21.0	2.4671	16	10.98
	10.0	264	23	38.6	+0	28	29.4	2.4851	16	03.96
	10.5	271	20	45.3	-0	09	14.2	2.5043	15	56.56
	11.0	278	11	01.9	0	46	14.7	2.5243	15	48.97
	11.5	284	54	31.2	1	22	01.3	2.5448	15	41.35
	12.0	291	31	24.4	-1	56	07.3	2.5652	15	33.84
	12.5	298	02	00.0	2	28	10.4	2.5853	15	26.59
	13.0	304	26	41.9	2	57	52.3	2.6046	15	19.71
	13.5	310	45	58.7	3	24	58.1	2.6229	15	13.30
	14.0	317	00	21.8	3	49	15.8	2.6399	15	07.43
	14.5	323	10	24.9	4	10	36.1	2.6553	15	02.15
	15.0	329	16	43.0	-4	28	51.6	2.6691	14	57.52
	15.5	335	19	51.2	4	43	56.9	2.6809	14	53.54
	16.0	341	20	24.6	4	55	47.9	2.6908	14	50.25
	16.5	347	18	57.2	5	04	21.4	2.6988	14	47.63
	17.0	353	16	01.9	-5	09	35.8	2.7047	14	45.68

MOON, 2020
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude °	'	"	Apparent Latitude °	'	"	True Geocentric Distance (A. U.) (X 10^{-3})	Semi Diameter '	"
May	17.0	353	16	01.9	-5	09	35.8	2.7047	14	45.68
	17.5	359	12	09.9	5	11	29.9	2.7087	14	44.38
	18.0	5	07	50.3	5	10	03.8	2.7108	14	43.70
	18.5	11	03	30.3	5	05	18.4	2.7110	14	43.62
	19.0	16	59	34.7	4	57	16.0	2.7096	14	44.09
	19.5	22	56	26.2	4	45	59.9	2.7066	14	45.07
	20.0	28	54	24.7	-4	31	34.7	2.7021	14	46.53
	20.5	34	53	48.3	4	14	06.9	2.6964	14	48.42
	21.0	40	54	52.7	3	53	44.4	2.6895	14	50.69
	21.5	46	57	51.6	3	30	37.3	2.6816	14	53.30
	22.0	53	02	57.1	3	04	57.3	2.6729	14	56.21
	22.5	59	10	19.7	2	36	58.5	2.6635	14	59.38
	23.0	65	20	08.7	-2	06	57.1	2.6535	15	02.77
	23.5	71	32	32.7	1	35	11.1	2.6430	15	06.35
	24.0	77	47	39.5	1	02	00.9	2.6322	15	10.09
	24.5	84	05	36.8	-0	27	48.5	2.6210	15	13.97
	25.0	90	26	32.3	+0	07	02.3	2.6096	15	17.96
	25.5	96	50	33.9	0	42	06.3	2.5980	15	22.07
	26.0	103	17	49.6	+1	16	56.9	2.5862	15	26.26
	26.5	109	48	28.0	1	51	06.8	2.5743	15	30.54
	27.0	116	22	37.6	2	24	07.9	2.5624	15	34.89
	27.5	123	00	27.1	2	55	31.8	2.5503	15	39.30
	28.0	129	42	04.4	3	24	50.2	2.5383	15	43.76
	28.5	136	27	36.9	3	51	35.1	2.5263	15	48.24
	29.0	143	17	09.9	+4	15	19.4	2.5144	15	52.72
	29.5	150	10	46.7	4	35	37.3	2.5028	15	57.15
	30.0	157	08	27.5	4	52	04.8	2.4915	16	01.49
	30.5	164	10	08.1	5	04	20.2	2.4807	16	05.67
	31.0	171	15	39.9	5	12	05.2	2.4706	16	09.63
	31.5	178	24	48.6	5	15	05.2	2.4613	16	13.27
June	1.0	185	37	14.0	+5	13	10.2	2.4532	16	16.51
	1.5	192	52	29.6	5	06	15.6	2.4463	16	19.24
	2.0	200	10	02.5	4	54	23.1	2.4410	16	21.38
	2.5	207	29	14.3	4	37	40.5	2.4374	16	22.82
	3.0	214	49	21.5	4	16	22.8	2.4357	16	23.49
	3.5	222	09	36.6	3	50	51.4	2.4362	16	23.32
	4.0	229	29	10.1	+3	21	34.1	2.4388	16	22.27
	4.5	236	47	11.6	2	49	04.0	2.4436	16	20.31
	5.0	244	02	51.7	2	13	58.6	2.4507	16	17.47
	5.5	251	15	24.1	1	36	58.1	2.4600	16	13.77
	6.0	258	24	06.4	0	58	44.1	2.4714	16	09.30
	6.5	265	28	22.1	+0	19	58.1	2.4846	16	04.14
	7.0	272	27	41.1	-0	18	40.0	2.4995	15	58.41
	7.5	279	21	40.8	0	56	33.1	2.5157	15	52.24
	8.0	286	10	05.7	1	33	07.5	2.5329	15	45.76
	8.5	292	52	48.1	2	07	53.8	2.5508	15	39.12
	9.0	299	29	47.4	-2	40	26.8	2.5690	15	32.46

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
June	9.0	299	29	47.4	-2	40	26.8	2.5690	15	32.46
	9.5	306	01	09.5	3	10	26.0	2.5872	15	25.91
	10.0	312	27	06.5	3	37	34.8	2.6050	15	19.59
	10.5	318	47	56.0	4	01	40.2	2.6221	15	13.60
	11.0	325	03	59.7	4	22	32.9	2.6381	15	08.05
	11.5	331	15	43.5	4	40	06.1	2.6529	15	03.00
	12.0	337	23	36.0	-4	54	15.5	2.6660	14	58.53
	12.5	343	28	08.4	5	04	58.6	2.6775	14	54.69
	13.0	349	29	53.3	5	12	14.4	2.6870	14	51.51
	13.5	355	29	24.6	5	16	03.3	2.6946	14	49.02
	14.0	1	27	16.4	5	16	26.5	2.7000	14	47.23
	14.5	7	24	03.1	5	13	26.0	2.7033	14	46.14
	15.0	13	20	18.6	-5	07	04.9	2.7045	14	45.74
	15.5	19	16	35.8	4	57	26.7	2.7037	14	46.02
	16.0	25	13	26.7	4	44	36.1	2.7009	14	46.95
	16.5	31	11	21.4	4	28	38.6	2.6962	14	48.49
	17.0	37	10	48.4	4	09	41.1	2.6898	14	50.61
	17.5	43	12	13.9	3	47	51.8	2.6818	14	53.24
	18.0	49	16	01.9	-3	23	20.5	2.6725	14	56.35
	18.5	55	22	33.6	2	56	19.1	2.6621	14	59.86
	19.0	61	32	07.4	2	27	01.3	2.6508	15	03.71
	19.5	67	44	58.8	1	55	43.5	2.6387	15	07.83
	20.0	74	01	20.4	1	22	44.1	2.6262	15	12.16
	20.5	80	21	21.2	-0	48	24.4	2.6134	15	16.63
	21.0	86	45	07.7	-0	13	07.8	2.6006	15	21.16
	21.5	93	12	43.0	+0	22	39.8	2.5878	15	25.70
	22.0	99	44	07.4	0	58	30.5	2.5753	15	30.18
	22.5	106	19	18.5	1	33	54.8	2.5633	15	34.55
	23.0	112	58	11.3	2	08	22.3	2.5518	15	38.77
	23.5	119	40	38.7	2	41	21.6	2.5408	15	42.81
	24.0	126	26	31.5	+3	12	21.8	2.5306	15	46.63
	24.5	133	15	39.2	3	40	52.6	2.5211	15	50.21
	25.0	140	07	49.5	4	06	25.1	2.5123	15	53.54
	25.5	147	02	49.4	4	28	32.6	2.5042	15	56.61
	26.0	154	00	24.7	4	46	51.3	2.4969	15	59.41
	26.5	161	00	20.6	5	01	00.6	2.4903	16	01.95
	27.0	168	02	21.7	+5	10	43.7	2.4844	16	04.21
	27.5	175	06	11.8	5	15	48.0	2.4793	16	06.20
	28.0	182	11	34.2	5	16	05.7	2.4750	16	07.89
	28.5	189	18	11.5	5	11	33.8	2.4715	16	09.27
	29.0	196	25	45.2	5	02	14.2	2.4688	16	10.31
	29.5	203	33	56.0	4	48	14.2	2.4671	16	10.99
	30.0	210	42	23.6	+4	29	46.0	2.4664	16	11.28
	30.5	217	50	46.2	4	07	07.2	2.4667	16	11.14
July	1.0	224	58	41.2	3	40	39.9	2.4682	16	10.54
	1.5	232	05	44.7	3	10	50.6	2.4710	16	09.44
	2.0	239	11	32.1	+2	38	10.0	2.4752	16	07.81

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
July	1.0	224	58	41.2	+3	40	39.9	2.4682	16	10.54
	1.5	232	05	44.7	3	10	50.6	2.4710	16	09.44
	2.0	239	11	32.1	2	38	10.0	2.4752	16	07.81
	2.5	246	15	38.2	2	03	11.5	2.4807	16	05.65
	3.0	253	17	37.6	1	26	31.1	2.4877	16	02.94
	3.5	260	17	05.3	0	48	46.0	2.4961	15	59.70
	4.0	267	13	37.2	+0	10	33.7	2.5059	15	55.95
	4.5	274	06	50.7	-0	27	28.9	2.5170	15	51.74
	5.0	280	56	25.6	1	04	46.7	2.5293	15	47.12
	5.5	287	42	04.3	1	40	47.0	2.5426	15	42.15
	6.0	294	23	32.6	2	15	00.1	2.5568	15	36.93
	6.5	301	00	40.1	2	47	00.1	2.5715	15	31.55
	7.0	307	33	20.5	-3	16	25.0	2.5867	15	26.10
	7.5	314	01	32.1	3	42	56.5	2.6019	15	20.68
	8.0	320	25	17.5	4	06	20.6	2.6170	15	15.38
	8.5	326	44	44.0	4	26	26.5	2.6315	15	10.31
	9.0	333	00	03.1	4	43	06.9	2.6454	15	05.56
	9.5	339	11	30.6	4	56	17.2	2.6582	15	01.19
	10.0	345	19	26.0	-5	05	55.5	2.6697	14	57.30
	10.5	351	24	12.6	5	12	01.7	2.6798	14	53.93
	11.0	357	26	16.6	5	14	37.4	2.6881	14	51.16
	11.5	3	26	06.8	5	13	45.4	2.6946	14	49.01
	12.0	9	24	14.5	5	09	29.9	2.6991	14	47.53
	12.5	15	21	12.6	5	01	55.5	2.7015	14	46.74
	13.0	21	17	35.5	-4	51	07.7	2.7018	14	46.66
	13.5	27	13	58.4	4	37	12.8	2.6999	14	47.28
	14.0	33	10	57.0	4	20	17.8	2.6958	14	48.60
	14.5	39	09	06.9	4	00	30.4	2.6898	14	50.61
	15.0	45	09	03.2	3	37	59.3	2.6818	14	53.27
	15.5	51	11	20.1	3	12	54.6	2.6719	14	56.55
	16.0	57	16	29.9	-2	45	27.6	2.6605	15	00.40
	16.5	63	25	03.2	2	15	51.7	2.6477	15	04.76
	17.0	69	37	27.5	1	44	22.2	2.6337	15	09.56
	17.5	75	54	07.2	1	11	16.6	2.6189	15	14.72
	18.0	82	15	22.5	0	36	55.3	2.6034	15	20.14
	18.5	88	41	29.2	-0	01	41.1	2.5877	15	25.74
	19.0	95	12	37.9	+0	34	00.1	2.5719	15	31.41
	19.5	101	48	53.3	1	09	40.2	2.5565	15	37.04
	20.0	108	30	14.3	1	44	48.3	2.5416	15	42.53
	20.5	115	16	33.3	2	18	52.2	2.5275	15	47.77
	21.0	122	07	36.6	2	51	18.0	2.5145	15	52.67
	21.5	129	03	04.2	3	21	32.0	2.5028	15	57.15
	22.0	136	02	30.6	+3	49	01.1	2.4924	16	01.13
	22.5	143	05	25.7	4	13	14.1	2.4835	16	04.56
	23.0	150	11	15.3	4	33	42.6	2.4762	16	07.41
	23.5	157	19	22.8	4	50	02.4	2.4705	16	09.65
	24.0	164	29	10.1	+5	01	53.8	2.4663	16	11.29

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude °	'	"	Apparent Latitude °	'	"	True Geocentric Distance (A. U.) (X 10^{-3})	Semi Diameter '	"
July	24.0	164	29	10.1	+5	01	53.8	2.4663	16	11.29
	24.5	171	39	59.6	5	09	02.7	2.4637	16	12.33
	25.0	178	51	14.5	5	11	20.9	2.4625	16	12.82
	25.5	186	02	20.9	5	08	45.9	2.4626	16	12.78
	26.0	193	12	48.0	5	01	21.3	2.4639	16	12.26
	26.5	200	22	08.8	4	49	16.2	2.4663	16	11.31
	27.0	207	30	00.9	+4	32	44.8	2.4697	16	09.97
	27.5	214	36	05.5	4	12	05.6	2.4740	16	08.28
	28.0	221	40	08.2	3	47	41.5	2.4791	16	06.28
	28.5	228	41	57.7	3	19	58.4	2.4850	16	04.00
	29.0	235	41	25.6	2	49	24.8	2.4915	16	01.46
	29.5	242	38	25.8	2	16	31.4	2.4987	15	58.69
	30.0	249	32	53.4	+1	41	50.3	2.5066	15	55.69
	30.5	256	24	44.5	1	05	54.5	2.5150	15	52.48
	31.0	263	13	55.3	+0	29	17.2	2.5241	15	49.06
	31.5	270	00	22.1	-0	07	28.8	2.5338	15	45.45
Aug.	1.0	276	44	00.4	0	43	51.3	2.5440	15	41.65
	1.5	283	24	45.7	1	19	19.8	2.5547	15	37.68
	2.0	290	02	32.6	-1	53	25.3	2.5660	15	33.56
	2.5	296	37	15.7	2	25	41.6	2.5777	15	29.32
	3.0	303	08	49.6	2	55	45.0	2.5898	15	25.00
	3.5	309	37	09.5	3	23	14.7	2.6020	15	20.63
	4.0	316	02	11.6	3	47	53.2	2.6144	15	16.27
	4.5	322	23	53.6	4	09	26.5	2.6268	15	11.97
	5.0	328	42	15.1	-4	27	43.6	2.6388	15	07.79
	5.5	334	57	18.4	4	42	36.7	2.6505	15	03.79
	6.0	341	09	08.5	4	54	01.0	2.6616	15	00.04
	6.5	347	17	53.4	5	01	54.2	2.6718	14	56.59
	7.0	353	23	44.8	5	06	16.5	2.6810	14	53.51
	7.5	359	26	57.5	5	07	10.1	2.6890	14	50.86
	8.0	5	27	49.9	-5	04	38.8	2.6955	14	48.70
	8.5	11	26	43.8	4	58	47.8	2.7005	14	47.07
	9.0	17	24	04.2	4	49	43.6	2.7037	14	46.03
	9.5	23	20	19.1	4	37	33.2	2.7050	14	45.61
	10.0	29	15	59.2	4	22	24.9	2.7043	14	45.84
	10.5	35	11	37.6	4	04	27.2	2.7015	14	46.74
	11.0	41	07	49.7	-3	43	49.6	2.6966	14	48.34
	11.5	47	05	12.0	3	20	42.0	2.6897	14	50.64
	12.0	53	04	22.7	2	55	15.5	2.6807	14	53.63
	12.5	59	06	00.1	2	27	41.8	2.6697	14	57.30
	13.0	65	10	42.8	1	58	14.3	2.6569	15	01.62
	13.5	71	19	08.6	1	27	07.5	2.6425	15	06.55
	14.0	77	31	53.5	-0	54	38.2	2.6266	15	12.03
	14.5	83	49	31.4	-0	21	04.9	2.6096	15	17.98
	15.0	90	12	32.5	+0	13	11.0	2.5916	15	24.33
	15.5	96	41	22.5	0	47	45.9	2.5731	15	30.97
	16.0	103	16	21.2	+1	22	13.1	2.5545	15	37.78

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Aug.	16.0	103	16	21.2	+1	22	13.1	2.5545	15	37.78
	16.5	109	57	41.6	1	56	03.4	2.5359	15	44.63
	17.0	116	45	28.5	2	28	45.0	2.5179	15	51.38
	17.5	123	39	37.3	2	59	44.5	2.5009	15	57.88
	18.0	130	39	54.0	3	28	27.0	2.4850	16	03.99
	18.5	137	45	53.9	3	54	18.1	2.4707	16	09.56
	19.0	144	57	02.7	+4	16	44.2	2.4583	16	14.45
	19.5	152	12	36.6	4	35	14.8	2.4480	16	18.56
	20.0	159	31	43.7	4	49	23.5	2.4399	16	21.80
	20.5	166	53	26.5	4	58	49.3	2.4342	16	24.10
	21.0	174	16	43.5	5	03	18.1	2.4309	16	25.45
	21.5	181	40	32.6	5	02	42.9	2.4299	16	25.84
	22.0	189	03	53.3	+4	57	04.6	2.4313	16	25.31
	22.5	196	25	49.3	4	46	31.4	2.4347	16	23.92
	23.0	203	45	30.9	4	31	18.2	2.4401	16	21.75
	23.5	211	02	15.7	4	11	46.0	2.4471	16	18.91
	24.0	218	15	30.4	3	48	20.5	2.4557	16	15.50
	24.5	225	24	50.4	3	21	31.1	2.4655	16	11.62
	25.0	232	29	59.7	+2	51	49.4	2.4763	16	07.39
	25.5	239	30	49.8	2	19	48.7	2.4878	16	02.91
	26.0	246	27	19.3	1	46	02.6	2.4999	15	58.25
	26.5	253	19	31.7	1	11	04.3	2.5123	15	53.51
	27.0	260	07	35.0	+0	35	26.5	2.5250	15	48.73
	27.5	266	51	39.6	-0	00	19.5	2.5377	15	43.97
	28.0	273	31	57.8	-0	35	44.0	2.5504	15	39.27
	28.5	280	08	42.3	1	10	18.8	2.5630	15	34.65
	29.0	286	42	05.4	1	43	37.8	2.5754	15	30.14
	29.5	293	12	18.6	2	15	17.1	2.5877	15	25.75
	30.0	299	39	32.1	2	44	54.7	2.5996	15	21.49
	30.5	306	03	54.5	3	12	11.2	2.6113	15	17.36
	31.0	312	25	32.8	-3	36	49.5	2.6227	15	13.38
	31.5	318	44	32.4	3	58	35.1	2.6338	15	09.55
Sept.	1.0	325	00	57.8	4	17	15.9	2.6444	15	05.88
	1.5	331	14	52.4	4	32	42.5	2.6546	15	02.40
	2.0	337	26	19.6	4	44	48.2	2.6643	14	59.11
	2.5	343	35	22.7	4	53	28.8	2.6735	14	56.04
	3.0	349	42	06.1	-4	58	42.4	2.6819	14	53.23
	3.5	355	46	35.3	5	00	29.5	2.6895	14	50.70
	4.0	1	48	57.7	4	58	52.7	2.6962	14	48.48
	4.5	7	49	22.8	4	53	56.3	2.7018	14	46.63
	5.0	13	48	02.9	4	45	46.5	2.7063	14	45.17
	5.5	19	45	13.1	4	34	30.8	2.7094	14	44.15
	6.0	25	41	11.4	-4	20	17.9	2.7111	14	43.61
	6.5	31	36	19.4	4	03	17.4	2.7111	14	43.59
	7.0	37	31	01.4	3	43	39.9	2.7095	14	44.12
	7.5	43	25	45.0	3	21	36.6	2.7060	14	45.25
	8.0	49	21	00.8	-2	57	19.5	2.7007	14	47.00

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Sept.	8.0	49	21	00.8	-2	57	19.5	2.7007	14	47.00
	8.5	55	17	22.1	2	31	01.2	2.6935	14	49.39
	9.0	61	15	24.6	2	02	55.1	2.6843	14	52.43
	9.5	67	15	45.9	1	33	15.5	2.6731	14	56.15
	10.0	73	19	05.3	1	02	17.5	2.6601	15	00.53
	10.5	79	26	02.7	-0	30	17.8	2.6454	15	05.55
	11.0	85	37	18.3	+0	02	25.7	2.6290	15	11.19
	11.5	91	53	31.4	0	35	33.0	2.6112	15	17.40
	12.0	98	15	19.3	1	08	42.4	2.5922	15	24.12
	12.5	104	43	16.4	1	41	29.6	2.5723	15	31.27
	13.0	111	17	52.2	2	13	28.3	2.5519	15	38.73
	13.5	117	59	30.0	2	44	09.5	2.5312	15	46.39
	14.0	124	48	25.0	+3	13	02.3	2.5108	15	54.11
	14.5	131	44	43.1	3	39	34.3	2.4909	16	01.71
	15.0	138	48	18.6	4	03	12.1	2.4721	16	09.03
	15.5	145	58	53.4	4	23	22.7	2.4547	16	15.88
	16.0	153	15	56.4	4	39	34.7	2.4392	16	22.08
	16.5	160	38	43.2	4	51	20.3	2.4260	16	27.45
	17.0	168	06	16.9	+4	58	16.4	2.4153	16	31.83
	17.5	175	37	30.4	5	00	06.9	2.4073	16	35.10
	18.0	183	11	08.3	4	56	43.3	2.4023	16	37.17
	18.5	190	45	51.2	4	48	06.1	2.4003	16	37.99
	19.0	198	20	18.7	4	34	24.7	2.4014	16	37.56
	19.5	205	53	13.5	4	15	57.0	2.4053	16	35.92
	20.0	213	23	24.8	+3	53	08.6	2.4120	16	33.16
	20.5	220	49	51.1	3	26	31.1	2.4212	16	29.39
	21.0	228	11	42.1	2	56	40.4	2.4326	16	24.77
	21.5	235	28	19.3	2	24	15.0	2.4458	16	19.44
	22.0	242	39	16.6	1	49	54.4	2.4605	16	13.58
	22.5	249	44	19.3	1	14	17.5	2.4764	16	07.35
	23.0	256	43	23.1	+0	38	01.5	2.4930	16	00.89
	23.5	263	36	32.1	+0	01	41.6	2.5101	15	54.34
	24.0	270	23	57.7	-0	34	10.3	2.5274	15	47.82
	24.5	277	05	56.6	1	09	04.9	2.5445	15	41.43
	25.0	283	42	48.9	1	42	36.4	2.5614	15	35.26
	25.5	290	14	57.1	2	14	21.7	2.5776	15	29.35
	26.0	296	42	44.8	-2	44	00.6	2.5933	15	23.75
	26.5	303	06	35.4	3	11	15.5	2.6081	15	18.50
	27.0	309	26	51.4	3	35	51.4	2.6220	15	13.61
	27.5	315	43	53.9	3	57	35.6	2.6351	15	09.09
	28.0	321	58	02.1	4	16	17.4	2.6472	15	04.94
	28.5	328	09	33.4	4	31	48.5	2.6583	15	01.16
	29.0	334	18	42.9	-4	44	02.4	2.6684	14	57.73
	29.5	340	25	43.7	4	52	54.7	2.6776	14	54.65
	30.0	346	30	47.3	4	58	23.0	2.6859	14	51.90
	30.5	352	34	03.8	5	00	26.9	2.6932	14	49.49
Oct.	1.0	358	35	42.1	-4	59	07.8	2.6995	14	47.40

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Oct.	1.0	358	35	42.1	-4	59	07.8	2.6995	14	47.40
	1.5	4	35	50.8	4	54	29.1	2.7048	14	45.64
	2.0	10	34	38.4	4	46	35.8	2.7092	14	44.21
	2.5	16	32	13.8	4	35	34.7	2.7126	14	43.12
	3.0	22	28	47.0	4	21	34.1	2.7148	14	42.38
	3.5	28	24	29.2	4	04	43.7	2.7160	14	42.02
	4.0	34	19	33.9	-3	45	14.6	2.7159	14	42.04
	4.5	40	14	16.3	3	23	18.8	2.7146	14	42.47
	5.0	46	08	54.4	2	59	09.5	2.7119	14	43.35
	5.5	52	03	48.7	2	33	00.6	2.7077	14	44.70
	6.0	57	59	22.7	2	05	06.8	2.7021	14	46.55
	6.5	63	56	02.5	1	35	43.6	2.6949	14	48.92
	7.0	69	54	17.1	-1	05	07.2	2.6861	14	51.84
	7.5	75	54	38.0	0	33	34.6	2.6756	14	55.33
	8.0	81	57	39.1	-0	01	23.4	2.6635	14	59.41
	8.5	88	03	56.1	+0	31	07.5	2.6497	15	04.07
	9.0	94	14	06.0	1	03	38.2	2.6344	15	09.32
	9.5	100	28	46.5	1	35	47.7	2.6177	15	15.14
	10.0	106	48	35.0	+2	07	13.4	2.5996	15	21.50
	10.5	113	14	07.7	2	37	31.2	2.5804	15	28.34
	11.0	119	45	57.8	3	06	15.2	2.5604	15	35.61
	11.5	126	24	34.7	3	32	58.2	2.5398	15	43.20
	12.0	133	10	21.7	3	57	11.5	2.5189	15	51.01
	12.5	140	03	34.3	4	18	25.8	2.4982	15	58.90
	13.0	147	04	18.5	+4	36	11.2	2.4780	16	06.71
	13.5	154	12	28.9	4	49	59.1	2.4588	16	14.26
	14.0	161	27	47.4	4	59	22.8	2.4410	16	21.35
	14.5	168	49	41.8	5	03	59.3	2.4251	16	27.80
	15.0	176	17	26.3	5	03	31.1	2.4115	16	33.39
	15.5	183	50	01.6	4	57	47.6	2.4004	16	37.96
	16.0	191	26	16.9	+4	46	46.2	2.3923	16	41.33
	16.5	199	04	52.8	4	30	34.0	2.3874	16	43.40
	17.0	206	44	24.3	4	09	27.2	2.3858	16	44.07
	17.5	214	23	25.2	3	43	51.4	2.3875	16	43.35
	18.0	222	00	32.0	3	14	19.8	2.3925	16	41.25
	18.5	229	34	27.7	2	41	32.0	2.4007	16	37.86
	19.0	237	04	04.5	+2	06	11.8	2.4117	16	33.31
	19.5	244	28	26.7	1	29	04.6	2.4252	16	27.76
	20.0	251	46	51.2	0	50	55.9	2.4409	16	21.39
	20.5	258	58	47.8	+0	12	29.1	2.4584	16	14.41
	21.0	266	03	59.3	-0	25	35.7	2.4773	16	07.00
	21.5	273	02	19.6	1	02	42.3	2.4970	15	59.36
	22.0	279	53	52.5	-1	38	19.2	2.5172	15	51.66
	22.5	286	38	50.1	2	11	59.6	2.5375	15	44.04
	23.0	293	17	31.1	2	43	21.0	2.5576	15	36.64
	23.5	299	50	18.8	3	12	05.0	2.5771	15	29.55
	24.0	306	17	39.7	-3	37	57.0	2.5957	15	22.87

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Oct.	24.0	306	17	39.7	-3	37	57.0	2.5957	15	22.87
	24.5	312	40	02.7	4	00	45.3	2.6133	15	16.65
	25.0	318	57	57.1	4	20	21.1	2.6297	15	10.94
	25.5	325	11	52.5	4	36	37.9	2.6448	15	05.76
	26.0	331	22	17.6	4	49	31.2	2.6584	15	01.12
	26.5	337	29	39.7	4	58	58.2	2.6705	14	57.03
	27.0	343	34	24.7	-5	04	57.9	2.6812	14	53.47
	27.5	349	36	56.2	5	07	30.5	2.6903	14	50.43
	28.0	355	37	36.1	5	06	37.9	2.6980	14	47.89
	28.5	1	36	44.1	5	02	23.2	2.7043	14	45.83
	29.0	7	34	38.1	4	54	51.1	2.7092	14	44.22
	29.5	13	31	34.2	4	44	07.4	2.7128	14	43.04
	30.0	19	27	47.0	-4	30	19.8	2.7152	14	42.27
	30.5	25	23	30.1	4	13	37.0	2.7164	14	41.88
	31.0	31	18	56.3	3	54	09.4	2.7165	14	41.85
	31.5	37	14	17.7	3	32	08.7	2.7155	14	42.18
Nov.	1.0	43	09	46.9	3	07	47.9	2.7134	14	42.86
	1.5	49	05	36.6	2	41	21.5	2.7102	14	43.88
	2.0	55	02	00.4	-2	13	04.8	2.7061	14	45.25
	2.5	60	59	13.1	1	43	14.6	2.7008	14	46.96
	3.0	66	57	31.0	1	12	08.4	2.6945	14	49.04
	3.5	72	57	12.0	0	40	04.6	2.6871	14	51.49
	4.0	78	58	36.0	-0	07	22.5	2.6785	14	54.34
	4.5	85	02	04.8	+0	25	38.0	2.6689	14	57.59
	5.0	91	08	02.2	+0	58	36.2	2.6580	15	01.26
	5.5	97	16	53.8	1	31	10.9	2.6459	15	05.37
	6.0	103	29	06.7	2	03	00.1	2.6327	15	09.92
	6.5	109	45	09.5	2	33	41.2	2.6183	15	14.92
	7.0	116	05	31.0	3	02	51.1	2.6028	15	20.36
	7.5	122	30	40.3	3	30	05.7	2.5863	15	26.22
	8.0	129	01	05.2	+3	55	00.8	2.5690	15	32.47
	8.5	135	37	11.6	4	17	11.5	2.5510	15	39.06
	9.0	142	19	22.0	4	36	12.9	2.5325	15	45.93
	9.5	149	07	54.2	4	51	40.2	2.5137	15	52.97
	10.0	156	02	59.8	5	03	09.6	2.4951	16	00.09
	10.5	163	04	42.4	5	10	19.2	2.4769	16	07.14
	11.0	170	12	56.4	+5	12	49.6	2.4595	16	13.99
	11.5	177	27	25.6	5	10	25.4	2.4433	16	20.45
	12.0	184	47	42.5	5	02	56.4	2.4287	16	26.35
	12.5	192	13	08.0	4	50	18.9	2.4160	16	31.51
	13.0	199	42	51.5	4	32	37.0	2.4058	16	35.74
	13.5	207	15	52.4	4	10	03.0	2.3982	16	38.89
	14.0	214	51	02.1	+3	42	58.1	2.3935	16	40.84
	14.5	222	27	06.1	3	11	51.9	2.3920	16	41.48
	15.0	230	02	47.4	2	37	21.6	2.3937	16	40.77
	15.5	237	36	50.1	2	00	10.2	2.3986	16	38.72
	16.0	245	08	01.7	+1	21	04.7	2.4066	16	35.39

MOON, 2020
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Nov.	16.0	245	08	01.7	+1	21	04.7	2.4066	16	35.39
	16.5	252	35	16.8	0	40	53.9	2.4176	16	30.88
	17.0	259	57	38.7	+0	00	26.0	2.4312	16	25.33
	17.5	267	14	21.4	-0	39	33.0	2.4471	16	18.91
	18.0	274	24	49.9	1	18	21.5	2.4650	16	11.82
	18.5	281	28	40.9	1	55	22.6	2.4843	16	04.26
	19.0	288	25	41.7	-2	30	05.4	2.5047	15	56.41
	19.5	295	15	49.8	3	02	04.4	2.5257	15	48.46
	20.0	301	59	11.7	3	30	59.8	2.5468	15	40.59
	20.5	308	36	01.0	3	56	36.9	2.5678	15	32.93
	21.0	315	06	38.0	4	18	45.3	2.5881	15	25.61
	21.5	321	31	27.3	4	37	18.3	2.6074	15	18.73
	22.0	327	50	57.3	-4	52	12.3	2.6256	15	12.37
	22.5	334	05	38.9	5	03	26.1	2.6424	15	06.59
	23.0	340	16	04.5	5	11	00.7	2.6575	15	01.43
	23.5	346	22	46.8	5	14	58.3	2.6709	14	56.91
	24.0	352	26	18.7	5	15	22.6	2.6824	14	53.05
	24.5	358	27	12.6	5	12	18.4	2.6921	14	49.85
	25.0	4	25	59.5	-5	05	51.1	2.6999	14	47.28
	25.5	10	23	09.2	4	56	07.5	2.7058	14	45.33
	26.0	16	19	09.7	4	43	14.8	2.7100	14	43.97
	26.5	22	14	27.2	4	27	21.6	2.7124	14	43.18
	27.0	28	09	26.1	4	08	37.3	2.7132	14	42.90
	27.5	34	04	28.6	3	47	12.5	2.7126	14	43.12
	28.0	39	59	55.2	-3	23	19.0	2.7105	14	43.79
	28.5	45	56	04.4	2	57	10.1	2.7072	14	44.86
	29.0	51	53	13.2	2	29	00.3	2.7028	14	46.32
	29.5	57	51	37.0	1	59	05.6	2.6973	14	48.10
	30.0	63	51	29.8	1	27	43.5	2.6910	14	50.20
	30.5	69	53	05.0	0	55	12.7	2.6838	14	52.58
Dec.	1.0	75	56	34.7	-0	21	53.2	2.6759	14	55.21
	1.5	82	02	11.1	+0	11	53.6	2.6674	14	58.09
	2.0	88	10	05.7	0	45	45.7	2.6582	15	01.20
	2.5	94	20	30.4	1	19	19.9	2.6484	15	04.52
	3.0	100	33	37.1	1	52	12.8	2.6380	15	08.07
	3.5	106	49	38.3	2	24	00.2	2.6272	15	11.83
	4.0	113	08	46.6	+2	54	18.1	2.6157	15	15.82
	4.5	119	31	15.6	3	22	42.3	2.6038	15	20.02
	5.0	125	57	18.6	3	48	49.0	2.5913	15	24.45
	5.5	132	27	09.7	4	12	15.0	2.5783	15	29.10
	6.0	139	01	02.1	4	32	37.7	2.5649	15	33.96
	6.5	145	39	08.9	4	49	35.7	2.5511	15	39.01
	7.0	152	21	41.4	+5	02	48.9	2.5370	15	44.23
	7.5	159	08	49.3	5	11	58.9	2.5228	15	49.57
	8.0	166	00	39.2	5	16	49.8	2.5085	15	54.98
	8.5	172	57	14.0	5	17	08.4	2.4943	16	00.39
	9.0	179	58	32.0	+5	12	44.9	2.4806	16	05.70

MOON, 2020
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude °	'	"	Apparent Latitude °	'	"	True Geocentric Distance (A. U.) (X 10^{-3})	Semi Diameter '	"
Dec.	9.0	179	58	32.0	+5	12	44.9	2.4806	16	05.70
	9.5	187	04	26.0	5	03	33.8	2.4675	16	10.82
	10.0	194	14	42.5	4	49	34.6	2.4554	16	15.62
	10.5	201	29	00.9	4	30	52.4	2.4445	16	19.97
	11.0	208	46	53.6	4	07	38.6	2.4351	16	23.75
	11.5	216	07	45.5	3	40	11.3	2.4276	16	26.81
	12.0	223	30	54.9	+3	08	55.5	2.4221	16	29.03
	12.5	230	55	33.9	2	34	22.7	2.4190	16	30.30
	13.0	238	20	49.9	1	57	10.2	2.4184	16	30.54
	13.5	245	45	46.8	1	18	00.2	2.4205	16	29.70
	14.0	253	09	27.5	+0	37	37.8	2.4252	16	27.76
	14.5	260	30	55.5	-0	03	10.3	2.4327	16	24.74
	15.0	267	49	16.7	-0	43	37.8	2.4427	16	20.71
	15.5	275	03	41.8	1	23	00.8	2.4550	16	15.76
	16.0	282	13	27.4	2	00	38.9	2.4695	16	10.03
	16.5	289	17	57.7	2	35	56.7	2.4859	16	03.66
	17.0	296	16	44.7	3	08	24.5	2.5037	15	56.81
	17.5	303	09	29.4	3	37	38.6	2.5225	15	49.66
	18.0	309	56	01.3	-4	03	21.1	2.5420	15	42.37
	18.5	316	36	18.2	4	25	19.7	2.5618	15	35.09
	19.0	323	10	25.5	4	43	26.7	2.5814	15	27.98
	19.5	329	38	35.7	4	57	39.1	2.6006	15	21.16
	20.0	336	01	07.4	5	07	57.0	2.6188	15	14.74
	20.5	342	18	24.2	5	14	23.2	2.6359	15	08.81
	21.0	348	30	53.8	-5	17	02.9	2.6515	15	03.46
	21.5	354	39	07.3	5	16	02.6	2.6654	14	58.73
	22.0	0	43	38.1	5	11	29.8	2.6775	14	54.67
	22.5	6	45	01.1	5	03	33.2	2.6876	14	51.31
	23.0	12	43	52.1	4	52	21.7	2.6957	14	48.65
	23.5	18	40	47.4	4	38	05.0	2.7016	14	46.70
	24.0	24	36	22.9	-4	20	53.2	2.7054	14	45.45
	24.5	30	31	13.7	4	00	56.8	2.7072	14	44.87
	25.0	36	25	53.8	3	38	27.0	2.7070	14	44.95
	25.5	42	20	55.7	3	13	36.0	2.7049	14	45.64
	26.0	48	16	50.1	2	46	36.7	2.7010	14	46.90
	26.5	54	14	05.3	2	17	43.3	2.6956	14	48.69
	27.0	60	13	07.4	-1	47	11.2	2.6887	14	50.95
	27.5	66	14	20.0	1	15	17.3	2.6807	14	53.63
	28.0	72	18	03.6	0	42	20.0	2.6716	14	56.67
	28.5	78	24	36.0	-0	08	39.5	2.6617	15	00.01
	29.0	84	34	11.9	+0	25	22.7	2.6511	15	03.59
	29.5	90	47	03.0	0	59	23.3	2.6401	15	07.35
	30.0	97	03	17.8	+1	32	58.0	2.6288	15	11.25
	30.5	103	23	02.1	2	05	41.2	2.6174	15	15.23
	31.0	109	46	18.8	2	37	06.7	2.6060	15	19.25
	31.5	116	13	08.3	3	06	48.1	2.5946	15	23.27
	32.0	122	43	28.7	+3	34	19.1	2.5834	15	27.26

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Jan.	0.0	22	30	44.46	-14	03	06.46	54	33.04
	0.5	22	53	55.73	12	04	04.59	54	24.23
	1.0	23	16	38.29	9	58	41.62	54	17.67
	1.5	23	38	57.59	7	48	10.67	54	13.51
	2.0	0	00	59.58	5	33	39.54	54	11.88
	2.5	0	22	50.52	-3	16	11.78	54	12.87
	3.0	0	44	36.93	-0	56	48.34	54	16.51
	3.5	1	06	25.48	+1	23	30.80	54	22.83
	4.0	1	28	22.95	3	43	44.65	54	31.78
	4.5	1	50	36.19	6	02	49.28	54	43.29
	5.0	2	13	12.00	8	19	35.81	54	57.25
	5.5	2	36	17.09	10	32	48.50	55	13.47
	6.0	2	59	57.84	+12	41	03.07	55	31.76
	6.5	3	24	20.16	14	42	45.44	55	51.84
	7.0	3	49	29.12	16	36	11.08	56	13.39
	7.5	4	15	28.62	18	19	25.47	56	36.04
	8.0	4	42	20.88	19	50	25.85	56	59.38
	8.5	5	10	06.03	21	07	04.70	57	22.95
	9.0	5	38	41.63	+22	07	15.15	57	46.29
	9.5	6	08	02.45	22	48	58.17	58	08.89
	10.0	6	38	00.46	23	10	31.07	58	30.27
	10.5	7	08	25.20	23	10	36.29	58	49.96
	11.0	7	39	04.56	22	48	29.10	59	07.55
	11.5	8	09	45.83	22	04	02.92	59	22.67
	12.0	8	40	16.88	+20	57	51.09	59	35.05
	12.5	9	10	27.22	19	31	04.98	59	44.51
	13.0	9	40	08.82	17	45	28.82	59	50.95
	13.5	10	09	16.51	15	43	12.40	59	54.40
	14.0	10	37	48.03	13	26	42.94	59	54.96
	14.5	11	05	43.77	10	58	37.35	59	52.82
	15.0	11	33	06.35	+8	21	35.76	59	48.22
	15.5	12	00	00.07	5	38	16.57	59	41.46
	16.0	12	26	30.50	2	51	13.30	59	32.84
	16.5	12	52	43.93	+0	02	52.84	59	22.70
	17.0	13	18	47.04	-2	44	25.11	59	11.31
	17.5	13	44	46.50	5	28	27.83	58	58.97
	18.0	14	10	48.72	-8	07	08.94	58	45.90
	18.5	14	36	59.49	10	38	27.73	58	32.32
	19.0	15	03	23.77	13	00	28.78	58	18.37
	19.5	15	30	05.32	15	11	22.02	58	04.17
	20.0	15	57	06.49	17	09	23.60	57	49.82
	20.5	16	24	27.93	18	52	57.50	57	35.36
	21.0	16	52	08.46	-20	20	37.96	57	20.83
	21.5	17	20	04.97	21	31	12.51	57	06.26
	22.0	17	48	12.53	22	23	45.21	56	51.67
	22.5	18	16	24.69	22	57	39.71	56	37.07
	23.0	18	44	33.95	-23	12	41.45	56	22.51

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Jan.	23.0	18	44	33.95	-23	12	41.45	56	22.51
	23.5	19	12	32.32	23	08	58.72	56	08.03
	24.0	19	40	12.01	22	47	02.08	55	53.70
	24.5	20	07	26.03	22	07	42.36	55	39.62
	25.0	20	34	08.68	21	12	07.30	55	25.90
	25.5	21	00	15.88	20	01	37.47	55	12.68
	26.0	21	25	45.27	-18	37	41.90	55	00.12
	26.5	21	50	36.22	17	01	53.92	54	48.38
	27.0	22	14	49.66	15	15	47.57	54	37.66
	27.5	22	38	27.85	13	20	54.91	54	28.15
	28.0	23	01	34.18	11	18	44.02	54	20.04
	28.5	23	24	12.89	9	10	37.97	54	13.52
	29.0	23	46	28.90	-6	57	54.44	54	08.80
	29.5	0	08	27.64	4	41	45.92	54	06.03
	30.0	0	30	14.91	-2	23	20.45	54	05.40
	30.5	0	51	56.80	+0	03	42.66	54	07.03
	31.0	1	13	39.59	2	16	04.88	54	11.06
	31.5	1	35	29.74	4	35	00.04	54	17.57
Feb.	1.0	1	57	33.82	+6	51	59.49	54	26.64
	1.5	2	19	58.42	9	05	56.84	54	38.29
	2.0	2	42	50.09	11	15	40.85	54	52.51
	2.5	3	06	15.18	13	19	53.71	55	09.25
	3.0	3	30	19.69	15	17	09.53	55	28.39
	3.5	3	55	08.97	17	05	53.32	55	49.77
	4.0	4	20	47.41	+18	44	20.77	56	13.16
	4.5	4	47	17.99	20	10	38.96	56	38.26
	5.0	5	14	41.87	21	22	48.72	57	04.70
	5.5	5	42	57.92	22	18	48.62	57	32.06
	6.0	6	12	02.42	22	56	40.92	57	59.80
	6.5	6	41	48.87	23	14	39.18	58	27.38
	7.0	7	12	08.28	+23	11	16.91	58	54.16
	7.5	7	42	49.66	22	45	36.19	59	19.51
	8.0	8	13	40.97	21	57	14.81	59	42.77
	8.5	8	44	30.16	20	46	30.79	60	03.32
	9.0	9	15	06.32	19	14	23.41	60	20.61
	9.5	9	45	20.57	17	22	30.55	60	34.16
	10.0	10	15	06.60	+15	13	03.12	60	43.64
	10.5	10	44	20.94	12	48	37.37	60	48.85
	11.0	11	13	02.76	10	12	06.56	60	49.74
	11.5	11	41	13.55	7	26	32.88	60	46.42
	12.0	12	08	56.64	4	35	00.33	60	39.16
	12.5	12	36	16.70	+1	40	29.22	60	28.33
	13.0	13	03	19.23	-1	14	07.93	60	14.38
	13.5	13	30	10.10	4	06	08.88	59	57.84
	14.0	13	56	55.23	6	53	03.06	59	39.26
	14.5	14	23	40.16	9	32	32.02	59	19.17
	15.0	14	50	29.79	-12	02	29.40	58	58.08

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Feb.	15.0	14	50	29.79	-12	02	29.40	58	58.08
	15.5	15	17	28.09	14	21	00.71	58	36.46
	16.0	15	44	37.84	16	26	23.23	58	14.71
	16.5	16	12	00.42	18	17	06.31	57	53.17
	17.0	16	39	35.63	19	51	52.04	57	32.12
	17.5	17	07	21.67	21	09	36.46	57	11.75
	18.0	17	35	15.15	-22	09	31.02	56	52.23
	18.5	18	03	11.31	22	51	04.04	56	33.66
	19.0	18	31	04.35	23	14	01.98	56	16.09
	19.5	18	58	47.89	23	18	29.99	55	59.56
	20.0	19	26	15.45	23	04	51.67	55	44.07
	20.5	19	53	20.97	22	33	47.86	55	29.61
	21.0	20	19	59.27	-21	46	14.58	55	16.17
	21.5	20	46	06.33	20	43	20.25	55	03.72
	22.0	21	11	39.53	19	26	22.68	54	52.25
	22.5	21	36	37.64	17	56	45.87	54	41.76
	23.0	22	01	00.82	16	15	57.23	54	32.27
	23.5	22	24	50.46	14	25	25.06	54	23.79
	24.0	22	48	08.97	-12	26	36.71	54	16.39
	24.5	23	10	59.67	10	20	57.15	54	10.12
	25.0	23	33	26.53	8	09	48.18	54	05.07
	25.5	23	55	34.09	5	54	28.02	54	01.34
	26.0	0	17	27.28	3	36	11.39	53	59.03
	26.5	0	39	11.33	-1	16	09.82	53	58.27
	27.0	1	00	51.73	+1	04	27.67	53	59.19
	27.5	1	22	34.11	3	24	33.75	54	01.91
	28.0	1	44	24.26	5	43	01.68	54	06.56
	28.5	2	06	28.01	7	58	44.17	54	13.26
	29.0	2	28	51.20	10	10	32.10	54	22.12
	29.5	2	51	39.60	12	17	13.19	54	33.23
Mar.	1.0	3	14	58.77	+14	17	30.80	54	46.64
	1.5	3	38	53.91	16	10	02.81	55	02.40
	2.0	4	03	29.64	17	53	20.93	55	20.49
	2.5	4	28	49.71	19	25	50.48	55	40.87
	3.0	4	54	56.71	20	45	51.02	56	03.43
	3.5	5	21	51.66	21	51	37.98	56	28.00
	4.0	5	49	33.79	+22	41	25.63	56	54.34
	4.5	6	18	00.18	23	13	31.39	57	22.14
	5.0	6	47	05.76	23	26	21.41	57	50.98
	5.5	7	16	43.44	23	18	37.16	58	20.40
	6.0	7	46	44.50	22	49	22.24	58	49.80
	6.5	8	16	59.29	21	58	08.57	59	18.57
	7.0	8	47	18.03	+20	45	01.30	59	45.98
	7.5	9	17	31.67	19	10	41.35	60	11.31
	8.0	9	47	32.65	17	16	25.72	60	33.83
	8.5	10	17	15.42	15	04	05.18	60	52.83
	9.0	10	46	36.65	+12	36	00.12	61	07.71

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension h	m	s	Apparent Declination °	'	"	Horizontal Parallax '	"
Mar.	9.0	10	46	36.65	+12	36	00.12	61	07.71
	9.5	11	15	35.25	9	54	54.83	61	17.98
	10.0	11	44	12.16	7	03	51.14	61	23.30
	10.5	12	12	29.92	4	06	01.69	61	23.52
	11.0	12	40	32.29	+1	04	43.56	61	18.69
	11.5	13	08	23.77	-1	56	47.57	61	09.06
	12.0	13	36	09.18	-4	55	22.43	60	55.01
	12.5	14	03	53.24	7	48	02.19	60	37.10
	13.0	14	31	40.15	10	32	01.68	60	15.96
	13.5	14	59	33.32	13	04	51.64	59	52.27
	14.0	15	27	35.01	15	24	20.50	59	26.73
	14.5	15	55	46.13	17	28	35.60	59	00.03
	15.0	16	24	06.06	-19	16	04.17	58	32.78
	15.5	16	52	32.61	20	45	34.10	58	05.55
	16.0	17	21	02.12	21	56	14.53	57	38.81
	16.5	17	49	29.68	22	47	35.99	57	12.96
	17.0	18	17	49.51	23	19	30.20	56	48.32
	17.5	18	45	55.40	23	32	09.05	56	25.13
	18.0	19	13	41.23	-23	26	03.00	56	03.55
	18.5	19	41	01.42	23	01	58.71	55	43.69
	19.0	20	07	51.36	22	20	56.23	55	25.62
	19.5	20	34	07.64	21	24	05.91	55	09.33
	20.0	20	59	48.20	20	12	45.31	54	54.83
	20.5	21	24	52.35	18	48	16.44	54	42.07
	21.0	21	49	20.65	-17	12	03.41	54	30.98
	21.5	22	13	14.79	15	25	30.58	54	21.51
	22.0	22	36	37.39	13	30	01.25	54	13.57
	22.5	22	59	31.84	11	26	56.92	54	07.12
	23.0	23	22	02.11	9	17	36.84	54	02.08
	23.5	23	44	12.59	7	03	17.93	53	58.40
	24.0	0	06	08.03	-4	45	15.02	53	56.06
	24.5	0	27	53.39	2	24	41.16	53	55.03
	25.0	0	49	33.79	-0	02	48.14	53	55.32
	25.5	1	11	14.43	+2	19	12.95	53	56.93
	26.0	1	33	00.60	4	40	11.04	53	59.92
	26.5	1	54	57.56	6	58	54.40	54	04.31
	27.0	2	17	10.52	+9	14	09.93	54	10.19
	27.5	2	39	44.56	11	24	42.44	54	17.61
	28.0	3	02	44.54	13	29	14.03	54	26.66
	28.5	3	26	14.96	15	26	23.60	54	37.41
	29.0	3	50	19.79	17	14	46.50	54	49.94
	29.5	4	15	02.30	18	52	54.69	55	04.31
	30.0	4	40	24.79	+20	19	17.22	55	20.56
	30.5	5	06	28.36	21	32	21.42	55	38.70
Apr.	31.0	5	33	12.73	22	30	34.88	55	58.72
	31.5	6	00	35.99	23	12	28.14	56	20.56
	1.0	6	28	34.58	+23	36	38.25	56	44.09

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Apr.	1.0	6	28	34.58	+23	36	38.25	56	44.09
	1.5	6	57	03.41	23	41	52.87	57	09.14
	2.0	7	25	56.04	23	27	14.66	57	35.45
	2.5	7	55	05.20	22	52	05.54	58	02.71
	3.0	8	24	23.32	21	56	10.37	58	30.50
	3.5	8	53	43.15	20	39	39.63	58	58.32
	4.0	9	22	58.38	+19	03	10.96	59	25.60
	4.5	9	52	04.11	17	07	49.48	59	51.70
	5.0	10	20	57.12	14	55	06.99	60	15.93
	5.5	10	49	36.06	12	27	00.33	60	37.59
	6.0	11	18	01.29	9	45	48.93	60	55.97
	6.5	11	46	14.75	6	54	11.84	61	10.43
	7.0	12	14	19.62	+3	55	04.29	61	20.44
	7.5	12	42	19.94	+0	51	33.67	61	25.60
	8.0	13	10	20.29	-2	13	04.88	61	25.66
	8.5	13	38	25.28	5	15	33.26	61	20.61
	9.0	14	06	39.19	8	12	35.48	61	10.58
	9.5	14	35	05.54	11	01	02.83	60	55.93
	10.0	15	03	46.68	-13	37	58.95	60	37.14
	10.5	15	32	43.46	16	00	44.63	60	14.84
	11.0	16	01	54.91	18	07	02.23	59	49.72
	11.5	16	31	18.20	19	54	59.39	59	22.51
	12.0	17	00	48.59	21	23	11.88	58	53.94
	12.5	17	30	19.74	22	30	45.31	58	24.72
	13.0	17	59	44.15	-23	17	15.45	57	55.46
	13.5	18	28	53.77	23	42	46.94	57	26.73
	14.0	18	57	40.69	23	47	50.56	56	59.01
	14.5	19	25	57.80	23	33	19.22	56	32.68
	15.0	19	53	39.26	23	00	23.09	56	08.06
	15.5	20	20	40.89	22	10	24.52	55	45.38
	16.0	20	47	00.27	-21	04	53.20	55	24.80
	16.5	21	12	36.71	19	45	21.98	55	06.42
	17.0	21	37	31.10	18	13	23.69	54	50.29
	17.5	22	01	45.63	16	30	28.81	54	36.41
	18.0	22	25	23.56	14	38	04.17	54	24.76
	18.5	22	48	28.97	12	37	32.41	54	15.26
	19.0	23	11	06.49	-10	30	12.01	54	07.85
	19.5	23	33	21.17	8	17	17.81	54	02.42
	20.0	23	55	18.33	6	00	01.71	53	58.87
	20.5	0	17	03.41	3	39	33.69	53	57.08
	21.0	0	38	41.95	-1	17	02.71	53	56.94
	21.5	1	00	19.50	+1	06	22.20	53	58.34
	22.0	1	22	01.55	+3	29	31.05	54	01.19
	22.5	1	43	53.54	5	51	11.99	54	05.38
	23.0	2	06	00.74	8	10	10.56	54	10.86
	23.5	2	28	28.21	10	25	09.10	54	17.55
	24.0	2	51	20.72	+12	34	46.31	54	25.42

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Apr.	24.0	2	51	20.72	+12	34	46.31	54	25.42
	24.5	3	14	42.55	14	37	37.17	54	34.43
	25.0	3	38	37.42	16	32	13.05	54	44.58
	25.5	4	03	08.21	18	17	02.37	54	55.87
	26.0	4	28	16.82	19	50	31.64	55	08.31
	26.5	4	54	03.91	21	11	07.22	55	21.92
	27.0	5	20	28.70	+22	17	17.56	55	36.72
	27.5	5	47	28.90	23	07	36.11	55	52.73
	28.0	6	15	00.63	23	40	44.69	56	09.95
	28.5	6	42	58.64	23	55	36.98	56	28.37
	29.0	7	11	16.51	23	51	21.99	56	47.93
	29.5	7	39	47.19	23	27	26.97	57	08.56
	30.0	8	08	23.50	+22	43	39.53	57	30.13
	30.5	8	36	58.73	21	40	08.74	57	52.47
May	1.0	9	05	27.16	20	17	25.31	58	15.31
	1.5	9	33	44.53	18	36	20.80	58	38.37
	2.0	10	01	48.22	16	38	06.40	59	01.26
	2.5	10	29	37.40	14	24	11.47	59	23.54
	3.0	10	57	12.94	+11	56	22.14	59	44.71
	3.5	11	24	37.27	9	16	40.07	60	04.23
	4.0	11	51	54.07	6	27	21.43	60	21.54
	4.5	12	19	08.03	3	30	55.94	60	36.05
	5.0	12	46	24.48	+0	30	05.74	60	47.26
	5.5	13	13	49.03	-2	32	16.13	60	54.68
	6.0	13	41	27.22	-5	33	08.01	60	57.97
	6.5	14	09	24.07	8	29	22.68	60	56.88
	7.0	14	37	43.64	11	17	51.52	60	51.34
	7.5	15	06	28.57	13	55	29.61	60	41.42
	8.0	15	35	39.64	16	19	21.77	60	27.36
	8.5	16	05	15.40	18	26	49.18	60	09.54
	9.0	16	35	11.93	-20	15	36.08	59	48.47
	9.5	17	05	22.86	21	43	55.94	59	24.72
	10.0	17	35	39.71	22	50	36.22	58	58.94
	10.5	18	05	52.47	23	35	01.06	58	31.78
	11.0	18	35	50.48	23	57	11.28	58	03.90
	11.5	19	05	23.40	23	57	41.58	57	35.90
	12.0	19	34	22.07	-23	37	35.41	57	08.35
	12.5	20	02	39.20	22	58	18.19	56	41.74
	13.0	20	30	09.79	22	01	29.93	56	16.48
	13.5	20	56	51.22	20	48	58.33	55	52.93
	14.0	21	22	43.11	19	22	32.86	55	31.37
	14.5	21	47	47.00	17	44	00.39	55	12.01
	15.0	22	12	05.98	-15	55	02.29	54	54.99
	15.5	22	35	44.35	13	57	12.94	54	40.40
	16.0	22	58	47.23	11	51	59.34	54	28.31
	16.5	23	21	20.30	9	40	41.55	54	18.69
	17.0	23	43	29.60	-7	24	33.68	54	11.53

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
May	17.0	23	43	29.60	-7	24	33.68	54	11.53
	17.5	0	05	21.36	5	04	45.29	54	06.75
	18.0	0	27	01.85	2	42	22.84	54	04.26
	18.5	0	48	37.40	-0	18	31.36	54	03.95
	19.0	1	10	14.24	+2	05	44.01	54	05.68
	19.5	1	31	58.52	4	29	16.52	54	09.30
	20.0	1	53	56.21	+6	50	56.43	54	14.66
	20.5	2	16	13.06	9	09	29.84	54	21.59
	21.0	2	38	54.51	11	23	37.83	54	29.93
	21.5	3	02	05.51	13	31	55.90	54	39.52
	22.0	3	25	50.41	15	32	53.82	54	50.21
	22.5	3	50	12.69	17	24	56.22	55	01.84
	23.0	4	15	14.73	+19	06	23.67	55	14.28
	23.5	4	40	57.56	20	35	34.76	55	27.42
	24.0	5	07	20.57	21	50	48.92	55	41.15
	24.5	5	34	21.40	22	50	30.10	55	55.38
	25.0	6	01	55.80	23	33	11.04	56	10.06
	25.5	6	29	57.84	23	57	37.81	56	25.12
	26.0	6	58	20.16	+24	02	54.10	56	40.53
	26.5	7	26	54.52	23	48	24.75	56	56.23
	27.0	7	55	32.48	23	13	57.90	57	12.21
	27.5	8	24	06.05	22	19	45.73	57	28.41
	28.0	8	52	28.36	21	06	23.53	57	44.78
	28.5	9	20	34.21	19	34	47.58	58	01.23
	29.0	9	48	20.27	+17	46	12.22	58	17.67
	29.5	10	15	45.30	15	42	06.76	58	33.94
	30.0	10	42	49.97	13	24	12.63	58	49.87
	30.5	11	09	36.74	10	54	21.13	59	05.23
	31.0	11	36	09.53	8	14	31.99	59	19.75
	31.5	12	02	33.44	5	26	52.56	59	33.12
June	1.0	12	28	54.41	+2	33	37.70	59	45.00
	1.5	12	55	18.90	-0	22	50.17	59	55.05
	2.0	13	21	53.60	3	20	00.89	60	02.89
	2.5	13	48	45.01	6	15	16.79	60	08.20
	3.0	14	15	59.14	9	05	53.59	60	10.66
	3.5	14	43	41.00	11	49	02.27	60	10.03
	4.0	15	11	54.19	-14	21	52.34	60	06.16
	4.5	15	40	40.37	16	41	36.36	59	58.98
	5.0	16	09	58.81	18	45	36.07	59	48.53
	5.5	16	39	46.06	20	31	29.45	59	34.97
	6.0	17	09	55.82	21	57	18.25	59	18.54
	6.5	17	40	19.21	23	01	35.08	58	59.59
	7.0	18	10	45.30	-23	43	28.70	58	38.55
	7.5	18	41	02.10	24	02	46.64	58	15.89
	8.0	19	10	57.57	23	59	54.44	57	52.12
	8.5	19	40	20.79	23	35	51.62	57	27.75
	9.0	20	09	02.83	-22	52	04.91	57	03.30

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension h	m	s	Apparent Declination °	'	"	Horizontal Parallax '	"
June	9.0	20	09	02.83	-22	52	04.91	57	03.30
	9.5	20	36	57.28	21	50	20.24	56	39.24
	10.0	21	04	00.46	20	32	34.41	56	16.02
	10.5	21	30	11.31	19	00	47.81	55	54.04
	11.0	21	55	31.05	17	16	58.64	55	33.64
	11.5	22	20	02.73	15	22	58.95	55	15.12
	12.0	22	43	50.81	-13	20	32.36	54	58.71
	12.5	23	07	00.72	11	11	13.24	54	44.60
	13.0	23	29	38.58	8	56	26.97	54	32.93
	13.5	23	51	50.89	6	37	30.92	54	23.78
	14.0	0	13	44.40	4	15	35.98	54	17.20
	14.5	0	35	25.94	-1	51	48.31	54	13.20
	15.0	0	57	02.35	+0	32	48.76	54	11.75
	15.5	1	18	40.45	2	57	12.73	54	12.78
	16.0	1	40	26.94	5	20	20.06	54	16.19
	16.5	2	02	28.40	7	41	04.34	54	21.85
	17.0	2	24	51.14	9	58	14.66	54	29.62
	17.5	2	47	41.17	12	10	34.26	54	39.30
	18.0	3	11	03.98	+14	16	39.49	54	50.70
	18.5	3	35	04.37	16	14	59.39	55	03.58
	19.0	3	59	46.15	18	03	55.96	55	17.72
	19.5	4	25	11.88	19	41	45.32	55	32.87
	20.0	4	51	22.46	21	06	40.03	55	48.76
	20.5	5	18	16.89	22	16	52.61	56	05.16
	21.0	5	45	52.00	+23	10	40.22	56	21.80
	21.5	6	14	02.42	23	46	30.30	56	38.45
	22.0	6	42	40.76	24	03	06.47	56	54.90
	22.5	7	11	38.01	23	59	34.20	57	10.96
	23.0	7	40	44.30	23	35	25.19	57	26.47
	23.5	8	09	49.66	22	50	39.84	57	41.28
	24.0	8	38	44.95	+21	45	47.54	57	55.30
	24.5	9	07	22.54	20	21	44.61	58	08.44
	25.0	9	35	36.89	18	39	50.68	58	20.67
	25.5	10	03	24.81	16	41	43.96	58	31.94
	26.0	10	30	45.41	14	29	16.47	58	42.25
	26.5	10	57	39.98	12	04	29.58	58	51.56
	27.0	11	24	11.68	+9	29	30.62	58	59.87
	27.5	11	50	25.12	6	46	30.46	59	07.15
	28.0	12	16	26.09	3	57	42.17	59	13.35
	28.5	12	42	21.10	+1	05	20.55	59	18.41
	29.0	13	08	17.14	-1	48	17.71	59	22.25
	29.5	13	34	21.32	4	40	53.51	59	24.76
	30.0	14	00	40.55	-7	30	04.89	59	25.83
	30.5	14	27	21.21	10	13	26.92	59	25.31
July	1.0	14	54	28.71	12	48	32.21	59	23.09
	1.5	15	22	07.13	15	12	52.58	59	19.05
	2.0	15	50	18.69	-17	24	01.90	59	13.08

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
July	1.0	14	54	28.71	-12	48	32.21	59	23.09
	1.5	15	22	07.13	15	12	52.58	59	19.05
	2.0	15	50	18.69	17	24	01.90	59	13.08
	2.5	16	19	03.36	19	19	40.42	59	05.14
	3.0	16	48	18.48	20	57	40.39	58	55.20
	3.5	17	17	58.61	22	16	12.65	58	43.30
	4.0	17	47	55.71	-23	13	53.26	58	29.54
	4.5	18	17	59.55	23	49	49.32	58	14.07
	5.0	18	47	58.61	24	03	42.72	57	57.09
	5.5	19	17	41.03	23	55	51.08	57	38.87
	6.0	19	46	55.74	23	27	05.49	57	19.71
	6.5	20	15	33.36	22	38	45.44	56	59.94
	7.0	20	43	26.86	-21	32	31.86	56	39.93
	7.5	21	10	31.81	20	10	19.41	56	20.02
	8.0	21	36	46.39	18	34	09.14	56	00.59
	8.5	22	02	11.13	16	46	02.27	55	41.97
	9.0	22	26	48.47	14	47	55.63	55	24.50
	9.5	22	50	42.39	12	41	38.61	55	08.48
	10.0	23	13	57.95	-10	28	51.65	54	54.18
	10.5	23	36	41.01	8	11	05.93	54	41.83
	11.0	23	58	57.91	5	49	43.91	54	31.64
	11.5	0	20	55.31	3	26	00.48	54	23.76
	12.0	0	42	40.03	-1	01	04.62	54	18.33
	12.5	1	04	18.97	+1	23	58.88	54	15.43
	13.0	1	25	59.04	+3	48	07.37	54	15.11
	13.5	1	47	47.13	6	10	18.42	54	17.39
	14.0	2	09	49.99	8	29	27.83	54	22.25
	14.5	2	32	14.24	10	44	27.75	54	29.61
	15.0	2	55	06.20	12	54	05.01	54	39.39
	15.5	3	18	31.73	14	56	59.76	54	51.44
	16.0	3	42	36.08	+16	51	44.53	55	05.57
	16.5	4	07	23.53	18	36	44.07	55	21.58
	17.0	4	32	57.10	20	10	16.05	55	39.20
	17.5	4	59	18.14	21	30	32.98	55	58.14
	18.0	5	26	26.02	22	35	45.54	56	18.06
	18.5	5	54	17.79	23	24	07.35	56	38.62
	19.0	6	22	48.12	+23	54	01.01	56	59.43
	19.5	6	51	49.38	24	04	04.91	57	20.10
	20.0	7	21	12.13	23	53	20.00	57	40.25
	20.5	7	50	45.83	23	21	15.46	57	59.50
	21.0	8	20	19.70	22	27	52.45	58	17.49
	21.5	8	49	43.76	21	13	45.27	58	33.93
	22.0	9	18	49.59	+19	39	59.72	58	48.55
	22.5	9	47	31.01	17	48	09.28	59	01.15
	23.0	10	15	44.30	15	40	09.77	59	11.60
	23.5	10	43	28.26	13	18	13.35	59	19.83
	24.0	11	10	43.98	+10	44	42.88	59	25.84

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
July	24.0	11	10	43.98	+10	44	42.88	59	25.84
	24.5	11	37	34.50	8	02	06.96	59	29.68
	25.0	12	04	04.39	5	12	56.21	59	31.47
	25.5	12	30	19.37	+2	19	40.63	59	31.33
	26.0	12	56	25.89	-0	35	11.89	59	29.42
	26.5	13	22	30.77	3	29	16.22	59	25.92
	27.0	13	48	40.88	-6	20	10.06	59	21.00
	27.5	14	15	02.82	9	05	33.79	59	14.79
	28.0	14	41	42.55	11	43	10.28	59	07.45
	28.5	15	08	45.06	14	10	45.18	58	59.08
	29.0	15	36	13.96	16	26	07.93	58	49.77
	29.5	16	04	11.11	18	27	13.62	58	39.59
	30.0	16	32	36.26	-20	12	06.04	58	28.58
	30.5	17	01	26.78	21	39	01.69	58	16.79
	31.0	17	30	37.66	22	46	34.55	58	04.24
	31.5	18	00	01.61	23	33	40.92	57	50.96
Aug.	1.0	18	29	29.57	23	59	43.69	57	37.01
	1.5	18	58	51.43	24	04	35.10	57	22.43
	2.0	19	27	56.86	-23	48	37.40	57	07.31
	2.5	19	56	36.25	23	12	41.16	56	51.75
	3.0	20	24	41.44	22	18	01.43	56	35.88
	3.5	20	52	06.28	21	06	12.33	56	19.86
	4.0	21	18	46.86	19	39	01.02	56	03.85
	4.5	21	44	41.52	17	58	21.66	55	48.07
	5.0	22	09	50.63	-16	06	10.20	55	32.72
	5.5	22	34	16.32	14	04	20.25	55	18.03
	6.0	22	58	02.08	11	54	40.18	55	04.24
	6.5	23	21	12.44	9	38	51.34	54	51.59
	7.0	23	43	52.70	7	18	27.35	54	40.28
	7.5	0	06	08.66	4	54	54.17	54	30.56
	8.0	0	28	06.46	-2	29	30.72	54	22.62
	8.5	0	49	52.46	-0	03	30.00	54	16.65
	9.0	1	11	33.11	+2	21	59.48	54	12.81
	9.5	1	33	14.94	4	45	52.19	54	11.26
	10.0	1	55	04.46	7	07	03.79	54	12.10
	10.5	2	17	08.14	9	24	29.46	54	15.43
	11.0	2	39	32.31	+11	37	02.11	54	21.31
	11.5	3	02	23.07	13	43	30.82	54	29.74
	12.0	3	25	46.13	15	42	39.40	54	40.73
	12.5	3	49	46.65	17	33	05.39	54	54.20
	13.0	4	14	28.93	19	13	19.53	55	10.06
	13.5	4	39	56.15	20	41	46.09	55	28.15
	14.0	5	06	09.98	+21	56	44.21	55	48.26
	14.5	5	33	10.28	22	56	30.48	56	10.13
	15.0	6	00	54.77	23	39	22.94	56	33.44
	15.5	6	29	18.93	24	03	46.38	56	57.82
	16.0	6	58	16.06	+24	08	18.65	57	22.82

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Aug.	16.0	6	58	16.06	+24	08	18.65	57	22.82
	16.5	7	27	37.62	23	51	57.28	57	47.98
	17.0	7	57	13.87	23	14	05.66	58	12.76
	17.5	8	26	54.69	22	14	37.79	58	36.63
	18.0	8	56	30.43	20	54	00.88	58	59.05
	18.5	9	25	52.81	19	13	15.52	59	19.48
	19.0	9	54	55.48	+17	13	53.43	59	37.45
	19.5	10	23	34.41	14	57	53.28	59	52.54
	20.0	10	51	47.95	12	27	35.46	60	04.43
	20.5	11	19	36.65	9	45	36.19	60	12.90
	21.0	11	47	03.03	6	54	41.98	60	17.83
	21.5	12	14	11.07	3	57	44.55	60	19.26
	22.0	12	41	05.92	+0	57	36.68	60	17.31
	22.5	13	07	53.39	-2	02	51.10	60	12.21
	23.0	13	34	39.59	5	00	52.86	60	04.26
	23.5	14	01	30.59	7	53	48.97	59	53.82
	24.0	14	28	32.02	10	39	07.26	59	41.29
	24.5	14	55	48.73	13	14	23.91	59	27.07
	25.0	15	23	24.43	-15	37	24.45	59	11.55
	25.5	15	51	21.34	17	46	05.04	58	55.08
	26.0	16	19	39.87	19	38	34.26	58	37.99
	26.5	16	48	18.45	21	13	15.45	58	20.56
	27.0	17	17	13.39	22	28	49.58	58	03.02
	27.5	17	46	19.02	23	24	18.21	57	45.54
	28.0	18	15	28.05	-23	59	06.14	57	28.28
	28.5	18	44	32.07	24	13	03.24	57	11.34
	29.0	19	13	22.27	24	06	24.93	56	54.77
	29.5	19	41	50.17	23	39	51.09	56	38.65
	30.0	20	09	48.28	22	54	23.43	56	23.00
	30.5	20	37	10.66	21	51	21.66	56	07.85
	31.0	21	03	53.18	-20	32	18.97	55	53.22
	31.5	21	29	53.63	18	58	57.37	55	39.16
Sept.	1.0	21	55	11.62	17	13	03.39	55	25.70
	1.5	22	19	48.39	15	16	24.45	55	12.90
	2.0	22	43	46.51	13	10	46.08	55	00.83
	2.5	23	07	09.61	10	57	49.92	54	49.57
	3.0	23	30	02.13	-8	39	12.57	54	39.24
	3.5	23	52	29.05	6	16	25.06	54	29.94
	4.0	0	14	35.78	3	50	52.84	54	21.82
	4.5	0	36	27.94	-1	23	56.16	54	15.00
	5.0	0	58	11.34	+1	03	09.19	54	09.65
	5.5	1	19	51.85	3	29	11.01	54	05.90
	6.0	1	41	35.37	+5	52	59.54	54	03.92
	6.5	2	03	27.75	8	13	26.32	54	03.84
	7.0	2	25	34.78	10	29	22.92	54	05.81
	7.5	2	48	02.07	12	39	39.71	54	09.95
	8.0	3	10	54.97	+14	43	04.66	54	16.36

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Sept.	8.0	3	10	54.97	+14	43	04.66	54	16.36
	8.5	3	34	18.45	16	38	22.38	54	25.13
	9.0	3	58	16.88	18	24	13.34	54	36.33
	9.5	4	22	53.86	19	59	13.64	54	49.96
	10.0	4	48	11.95	21	21	55.27	55	06.04
	10.5	5	14	12.38	22	30	47.28	55	24.48
	11.0	5	40	54.80	+23	24	17.80	55	45.19
	11.5	6	08	17.12	24	00	57.13	56	08.00
	12.0	6	36	15.39	24	19	21.78	56	32.67
	12.5	7	04	43.96	24	18	19.31	56	58.90
	13.0	7	33	35.73	23	56	53.43	57	26.30
	13.5	8	02	42.70	23	14	29.03	57	54.43
	14.0	8	31	56.59	+22	10	56.28	58	22.75
	14.5	9	01	09.57	20	46	33.59	58	50.67
	15.0	9	30	14.90	19	02	08.92	59	17.55
	15.5	9	59	07.47	16	58	59.54	59	42.70
	16.0	10	27	44.06	14	38	50.29	60	05.45
	16.5	10	56	03.45	12	03	50.80	60	25.17
	17.0	11	24	06.33	+9	16	31.79	60	41.26
	17.5	11	51	55.06	6	19	40.95	60	53.28
	18.0	12	19	33.33	3	16	18.51	61	00.88
	18.5	12	47	05.77	+0	09	32.73	61	03.89
	19.0	13	14	37.58	-2	57	24.57	61	02.30
	19.5	13	42	14.09	6	01	22.23	60	56.28
	20.0	14	10	00.39	-8	59	13.75	60	46.14
	20.5	14	38	00.87	11	48	00.99	60	32.32
	21.0	15	06	18.85	14	24	57.58	60	15.34
	21.5	15	34	56.18	16	47	32.14	59	55.79
	22.0	16	03	52.93	18	53	31.37	59	34.27
	22.5	16	33	07.13	20	41	03.04	59	11.38
	23.0	17	02	34.77	-22	08	38.78	58	47.66
	23.5	17	32	09.87	23	15	16.36	58	23.62
	24.0	18	01	44.92	24	00	21.29	57	59.69
	24.5	18	31	11.43	24	23	47.18	57	36.23
	25.0	19	00	20.64	24	25	54.68	57	13.55
	25.5	19	29	04.28	24	07	28.98	56	51.85
	26.0	19	57	15.20	-23	29	36.08	56	31.31
	26.5	20	24	47.84	22	33	38.19	56	12.03
	27.0	20	51	38.53	21	21	08.95	55	54.08
	27.5	21	17	45.46	19	53	48.87	55	37.49
	28.0	21	43	08.64	18	13	21.43	55	22.25
	28.5	22	07	49.60	16	21	29.98	55	08.35
	29.0	22	31	51.13	-14	19	55.63	54	55.76
	29.5	22	55	17.01	12	10	15.91	54	44.45
	30.0	23	18	11.71	9	54	04.03	54	34.37
	30.5	23	40	40.22	7	32	48.83	54	25.51
Oct.	1.0	0	02	47.81	-5	07	54.95	54	17.85

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Oct.	1.0	0	02	47.81	-5	07	54.95	54	17.85
	1.5	0	24	39.98	2	40	43.28	54	11.39
	2.0	0	46	22.27	-0	12	31.66	54	06.14
	2.5	1	08	00.29	+2	15	24.49	54	02.14
	3.0	1	29	39.57	4	41	51.33	53	59.43
	3.5	1	51	25.58	7	05	35.90	53	58.07
	4.0	2	13	23.62	+9	25	25.29	53	58.15
	4.5	2	35	38.81	11	40	05.99	53	59.75
	5.0	2	58	15.97	13	48	23.20	54	02.98
	5.5	3	21	19.51	15	49	00.35	54	07.93
	6.0	3	44	53.32	17	40	38.80	54	14.71
	6.5	4	09	00.56	19	21	57.84	54	23.41
	7.0	4	33	43.53	+20	51	35.07	54	34.14
	7.5	4	59	03.39	22	08	07.31	54	46.96
	8.0	5	25	00.06	23	10	12.05	55	01.92
	8.5	5	51	32.04	23	56	29.53	55	19.05
	9.0	6	18	36.36	24	25	45.39	55	38.33
	9.5	6	46	08.70	24	36	53.78	55	59.70
	10.0	7	14	03.56	+24	29	00.68	56	23.04
	10.5	7	42	14.67	24	01	27.09	56	48.17
	11.0	8	10	35.43	23	13	51.94	57	14.84
	11.5	8	38	59.49	22	06	14.25	57	42.73
	12.0	9	07	21.25	20	38	54.63	58	11.40
	12.5	9	35	36.31	18	52	36.01	58	40.36
	13.0	10	03	41.76	+16	48	23.67	59	09.03
	13.5	10	31	36.38	14	27	44.87	59	36.74
	14.0	10	59	20.62	11	52	28.18	60	02.80
	14.5	11	26	56.48	9	04	42.47	60	26.46
	15.0	11	54	27.29	6	06	55.70	60	47.01
	15.5	12	21	57.44	3	01	53.25	61	03.76
	16.0	12	49	32.06	+0	07	24.26	61	16.15
	16.5	13	17	16.59	-3	17	43.95	61	23.73
	17.0	13	45	16.44	6	25	44.46	61	26.22
	17.5	14	13	36.46	9	28	00.58	61	23.55
	18.0	14	42	20.55	12	21	08.77	61	15.84
	18.5	15	11	31.05	15	01	53.26	61	03.40
	19.0	15	41	08.35	-17	27	12.70	60	46.69
	19.5	16	11	10.48	19	34	26.78	60	26.31
	20.0	16	41	32.86	21	21	22.73	60	02.94
	20.5	17	12	08.44	22	46	20.67	59	37.30
	21.0	17	42	48.04	23	48	17.55	59	10.11
	21.5	18	13	21.07	24	26	48.68	58	42.06
	22.0	18	43	36.47	-24	42	06.73	58	13.77
	22.5	19	13	23.71	24	34	58.00	57	45.80
	23.0	19	42	33.68	24	06	36.61	57	18.62
	23.5	20	10	59.36	23	18	37.41	56	52.61
	24.0	20	38	36.14	-22	12	48.53	56	28.07

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Oct.	24.0	20	38	36.14	-22	12	48.53	56	28.07
	24.5	21	05	21.85	20	51	04.71	56	05.24
	25.0	21	31	16.55	19	15	21.72	55	44.27
	25.5	21	56	22.21	17	27	32.43	55	25.24
	26.0	22	20	42.23	15	29	24.25	55	08.22
	26.5	22	44	21.14	13	22	37.93	54	53.19
	27.0	23	07	24.19	-11	08	47.29	54	40.12
	27.5	23	29	57.10	8	49	19.75	54	28.97
	28.0	23	52	05.88	6	25	37.20	54	19.65
	28.5	0	13	56.60	3	58	57.15	54	12.08
	29.0	0	35	35.36	-1	30	34.01	54	06.18
	29.5	0	57	08.20	+0	58	19.74	54	01.84
	30.0	1	18	41.01	+3	26	32.31	53	59.00
	30.5	1	40	19.52	5	52	51.62	53	57.56
	31.0	2	02	09.24	8	16	04.38	53	57.47
	31.5	2	24	15.39	10	34	55.41	53	58.69
Nov.	1.0	2	46	42.82	12	48	07.15	54	01.17
	1.5	3	09	35.90	14	54	19.41	54	04.92
	2.0	3	32	58.37	+16	52	09.49	54	09.94
	2.5	3	56	53.20	18	40	12.65	54	16.24
	3.0	4	21	22.38	20	17	03.02	54	23.87
	3.5	4	46	26.72	21	41	14.98	54	32.87
	4.0	5	12	05.76	22	51	25.09	54	43.31
	4.5	5	38	17.57	23	46	14.48	54	55.24
	5.0	6	04	58.82	+24	24	31.56	55	08.73
	5.5	6	32	04.84	24	45	14.94	55	23.81
	6.0	6	59	29.94	24	47	36.13	55	40.53
	6.5	7	27	07.74	24	31	01.91	55	58.89
	7.0	7	54	51.71	23	55	15.98	56	18.86
	7.5	8	22	35.68	23	00	19.81	56	40.38
	8.0	8	50	14.33	+21	46	32.66	57	03.33
	8.5	9	17	43.60	20	14	30.96	57	27.53
	9.0	9	45	00.97	18	25	07.30	57	52.72
	9.5	10	12	05.60	16	19	29.42	58	18.59
	10.0	10	38	58.31	13	58	59.36	58	44.72
	10.5	11	05	41.48	11	25	13.06	59	10.63
	11.0	11	32	18.87	+8	40	00.36	59	35.75
	11.5	11	58	55.40	5	45	25.48	59	59.48
	12.0	12	25	36.84	+2	43	47.60	60	21.14
	12.5	12	52	29.59	-0	22	18.72	60	40.07
	13.0	13	19	40.26	3	30	03.55	60	55.62
	13.5	13	47	15.34	6	36	22.58	61	07.20
	14.0	14	15	20.71	-9	37	59.43	61	14.33
	14.5	14	44	01.10	12	31	29.51	61	16.69
	15.0	15	13	19.49	15	13	25.91	61	14.09
	15.5	15	43	16.50	17	40	26.98	61	06.57
	16.0	16	13	49.75	-19	49	25.59	60	54.34

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Nov.	16.0	16	13	49.75	-19	49	25.59	60	54.34
	16.5	16	44	53.60	21	37	39.20	60	37.77
	17.0	17	16	19.07	23	02	59.71	60	17.39
	17.5	17	47	54.34	24	04	01.53	59	53.83
	18.0	18	19	25.66	24	40	06.51	59	27.80
	18.5	18	50	38.68	24	51	24.52	59	00.02
	19.0	19	21	19.87	-24	38	49.48	58	31.21
	19.5	19	51	17.73	24	03	51.58	58	02.04
	20.0	20	20	23.67	23	08	27.16	57	33.12
	20.5	20	48	32.36	21	54	48.09	57	04.99
	21.0	21	15	41.68	20	25	12.13	56	38.11
	21.5	21	41	52.29	18	41	55.32	56	12.86
	22.0	22	07	07.13	-16	47	06.76	55	49.51
	22.5	22	31	30.80	14	42	45.63	55	28.29
	23.0	22	55	09.05	12	30	40.03	55	09.35
	23.5	23	18	08.37	10	12	27.24	54	52.78
	24.0	23	40	35.60	7	49	34.85	54	38.60
	24.5	0	02	37.79	5	23	22.36	54	26.82
	25.0	0	24	21.96	-2	55	03.16	54	17.39
	25.5	0	45	55.04	-0	25	46.49	54	10.23
	26.0	1	07	23.82	+2	03	20.67	54	05.25
	26.5	1	28	54.87	4	31	11.80	54	02.33
	27.0	1	50	34.50	6	56	39.20	54	01.34
	27.5	2	12	28.74	9	18	32.70	54	02.14
	28.0	2	34	43.21	+11	35	38.55	54	04.58
	28.5	2	57	23.04	13	46	38.72	54	08.54
	29.0	3	20	32.74	15	50	10.62	54	13.86
	29.5	3	44	15.96	17	44	47.34	54	20.43
	30.0	4	08	35.34	19	28	58.57	54	28.13
	30.5	4	33	32.23	21	01	12.16	54	36.86
Dec.	1.0	4	59	06.48	+22	19	56.48	54	46.53
	1.5	5	25	16.28	23	23	43.50	54	57.10
	2.0	5	51	58.10	24	11	12.40	55	08.50
	2.5	6	19	06.77	24	41	13.47	55	20.71
	3.0	6	46	35.74	24	52	51.89	55	33.73
	3.5	7	14	17.50	24	45	30.83	55	47.55
	4.0	7	42	04.21	+24	18	53.60	56	02.17
	4.5	8	09	48.30	23	33	04.44	56	17.61
	5.0	8	37	23.09	22	28	27.87	56	33.87
	5.5	9	04	43.31	21	05	47.04	56	50.94
	6.0	9	31	45.46	19	26	01.17	57	08.78
	6.5	9	58	27.92	17	30	22.81	57	27.33
	7.0	10	24	51.00	+15	20	15.28	57	46.49
	7.5	10	50	56.79	12	57	10.71	58	06.10
	8.0	11	16	48.95	10	22	48.76	58	25.96
	8.5	11	42	32.45	7	38	56.35	58	45.81
	9.0	12	08	13.35	+4	47	27.99	59	05.32

MOON, 2020

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Dec.	9.0	12	08	13.35	+4	47	27.99	59	05.32
	9.5	12	33	58.50	+1	50	26.86	59	24.11
	10.0	12	59	55.26	-1	09	53.89	59	41.73
	10.5	13	26	11.27	4	11	09.76	59	57.72
	11.0	13	52	54.04	7	10	43.88	60	11.59
	11.5	14	20	10.58	10	05	46.87	60	22.82
	12.0	14	48	06.88	-12	53	18.08	60	30.98
	12.5	15	16	47.28	15	30	08.58	60	35.65
	13.0	15	46	13.82	17	53	06.56	60	36.54
	13.5	16	16	25.51	19	59	05.08	60	33.44
	14.0	16	47	17.78	21	45	12.07	60	26.31
	14.5	17	18	42.26	23	09	01.71	60	15.22
	15.0	17	50	27.00	-24	08	45.48	60	00.42
	15.5	18	22	17.34	24	43	21.18	59	42.26
	16.0	18	53	57.26	24	52	37.60	59	21.21
	16.5	19	25	10.97	24	37	13.93	58	57.82
	17.0	19	55	44.54	23	58	33.81	58	32.69
	17.5	20	25	27.03	22	58	35.30	58	06.43
	18.0	20	54	11.15	-21	39	38.89	57	39.65
	18.5	21	21	53.33	20	04	15.76	57	12.94
	19.0	21	48	33.29	18	14	57.83	56	46.83
	19.5	22	14	13.53	16	14	10.40	56	21.78
	20.0	22	38	58.57	14	04	07.65	55	58.22
	20.5	23	02	54.34	11	46	50.46	55	36.47
	21.0	23	26	07.68	-9	24	06.12	55	16.81
	21.5	23	48	45.93	6	57	29.29	54	59.45
	22.0	0	10	56.63	4	28	23.78	54	44.55
	22.5	0	32	47.37	-1	58	04.70	54	32.20
	23.0	0	54	25.66	+0	32	19.16	54	22.44
	23.5	1	15	58.84	3	01	42.97	54	15.28
	24.0	1	37	34.06	+5	29	03.62	54	10.68
	24.5	1	59	18.19	7	53	17.62	54	08.57
	25.0	2	21	17.83	10	13	19.24	54	08.85
	25.5	2	43	39.16	12	27	58.91	54	11.38
	26.0	3	06	27.85	14	36	02.04	54	16.02
	26.5	3	29	48.90	16	36	08.31	54	22.58
	27.0	3	53	46.40	+18	26	51.58	54	30.89
	27.5	4	18	23.25	20	06	40.55	54	40.72
	28.0	4	43	40.94	21	34	00.41	54	51.87
	28.5	5	09	39.21	22	47	15.53	55	04.13
	29.0	5	36	15.86	23	44	53.08	55	17.27
	29.5	6	03	26.67	24	25	27.66	55	31.10
	30.0	6	31	05.47	+24	47	46.27	55	45.41
	30.5	6	59	04.51	24	50	53.29	56	00.02
	31.0	7	27	14.98	24	34	14.71	56	14.78
	31.5	7	55	27.71	23	57	40.87	56	29.54
	32.0	8	23	33.98	+23	01	27.48	56	44.20

MOON, 2020
AT EPHEMERIS TRANSIT

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Jan.	0		U	31	16	23.1	-11	18.9
	1	5.78	L	1	04	44.3	9	07.7
	1		U	1	17	05.1	6	51.6
	2	6.78	L	2	05	25.6	4	31.8
	2		U	2	17	46.0	-2	09.4
	3	7.78	L	3	06	06.4	+0	14.6
	3		U	3	18	26.9	+2	38.9
	4	8.78	L	4	06	47.6	5	02.7
	4		U	4	19	08.6	7	24.6
	5	9.78	L	5	07	30.1	9	43.4
	5		U	5	19	52.3	11	57.6
	6	10.78	L	6	08	15.2	14	05.6
	6		U	6	20	38.8	+16	05.4
	7	11.78	L	7	09	03.4	17	55.1
	7		U	7	21	29.0	19	32.5
	8	12.78	L	8	09	55.6	20	54.9
	8		U	8	22	23.0	22	00.2
	9	13.78	L	9	10	51.4	22	45.8
	9		U	9	23	20.5	+23	09.9
	10	14.78	L	10	11	50.1	23	10.7
	11	15.78	U	11	00	20.0	22	47.6
	11		L	11	12	49.9	22	00.2
	12	16.78	U	12	01	19.6	20	49.3
	12		L	12	13	48.8	19	16.3
	13	17.78	U	13	02	17.6	+17	23.3
	13		L	13	14	45.7	15	13.0
	14	18.78	U	14	03	13.1	12	48.0
	14		L	14	15	39.8	10	11.5
	15	19.78	U	15	04	06.0	7	26.4
	15		L	15	16	31.7	4	35.6
	16	20.78	U	16	04	57.0	+1	41.8
	16		L	16	17	22.0	-1	12.2
	17	21.78	U	17	05	46.8	4	04.0
	17		L	17	18	11.7	6	51.2
	18	22.78	U	18	06	36.7	9	31.5
	18		L	18	19	01.8	12	02.9
	19	23.78	U	19	07	27.3	-14	23.2
	19		L	19	19	53.1	16	30.5
	20	24.78	U	20	08	19.3	18	22.8
	20		L	20	20	45.9	19	58.6
	21	25.78	U	21	09	12.7	21	16.4
	21		L	21	21	39.8	22	15.0
	22	26.78	U	22	10	07.0	-22	53.6
	22		L	22	22	34.2	23	11.9
	23	27.78	U	23	11	01.2	23	10.0
	23		L	23	23	27.8	-22	48.4

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Jan.	23		L	23	23	27.8	-22	48.4
	24	28.78	U	24	11	54.0	22	08.1
	25	0.10	L	25	00	19.7	21	10.4
	25		U	25	12	44.6	19	56.8
	26	1.10	L	26	01	08.9	18	29.0
	26		U	26	13	32.5	16	48.8
	27	2.10	L	27	01	55.4	-14	57.9
	27		U	27	14	17.6	12	58.1
	28	3.10	L	28	02	39.3	10	50.9
	28		U	28	15	00.5	8	37.7
	29	4.10	L	29	03	21.3	6	20.1
	29		U	29	15	41.8	3	59.3
	30	5.10	L	30	04	02.1	-1	36.5
	30		U	30	16	22.4	+0	47.3
	31	6.10	L	31	04	42.7	3	10.8
	31		U	31	17	03.3	5	33.0
Feb.	1	7.10	L	1	05	24.1	7	52.7
	1		U	1	17	45.3	10	08.8
	2	8.10	L	2	06	07.1	+12	19.8
	2		U	2	18	29.6	14	24.3
	3	9.10	L	3	06	52.8	16	20.6
	3		U	3	19	16.9	18	07.0
	4	10.10	L	4	07	42.0	19	41.2
	4		U	4	20	08.0	21	01.2
	5	11.10	L	5	08	35.0	+22	04.6
	5		U	5	21	02.9	22	49.1
	6	12.10	L	6	09	31.7	23	12.6
	6		U	6	22	01.1	23	13.3
	7	13.10	L	7	10	30.9	22	50.0
	7		U	7	23	01.0	22	02.1
	8	14.10	L	8	11	31.1	+20	49.8
	9	15.10	U	9	00	00.9	19	14.3
	9		L	9	12	30.3	17	17.4
	10	16.10	U	10	00	59.2	15	01.7
	10		L	10	13	27.5	12	30.2
	11	17.10	U	11	01	55.2	9	46.2
	11		L	11	14	22.3	+6	53.1
	12	18.10	U	12	02	48.9	3	54.2
	12		L	12	15	15.1	+0	53.1
	13	19.10	U	13	03	41.0	-2	07.3
	13		L	13	16	06.7	5	04.0
	14	20.10	U	14	04	32.4	7	54.4
	14		L	14	16	58.1	-10	35.9
	15	21.10	U	15	05	23.8	13	06.3
	15		L	15	17	49.8	15	23.7
	16	22.10	U	16	06	16.0	-17	26.1

MOON, 2020
AT EPHEMERIS TRANSIT

Date	Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
	d		d	h	m	°	'
Feb. 16	22.10	U	16	06	16.0	-17	26.1
16		L	16	18	42.5	19	12.1
17	23.10	U	17	07	09.2	20	40.3
17		L	17	19	36.0	21	49.7
18	24.10	U	18	08	02.9	22	39.4
18		L	18	20	29.8	23	09.2
19	25.10	U	19	08	56.6	-23	19.1
19		L	19	21	23.1	23	09.3
20	26.10	U	20	09	49.2	22	40.7
20		L	20	22	14.8	21	54.2
21	27.10	U	21	10	39.9	20	51.1
21		L	21	23	04.3	19	32.8
22	28.10	U	22	11	28.2	-18	01.0
22		L	22	23	51.3	16	17.2
23	29.10	U	23	12	13.9	14	23.2
24	0.35	L	24	00	35.8	12	20.5
24		U	24	12	57.3	10	10.7
25	1.35	L	25	01	18.4	7	55.3
25		U	25	13	39.1	-5	35.6
26	2.35	L	26	01	59.5	3	13.0
26		U	26	14	19.8	-0	48.9
27	3.35	L	27	02	40.1	+1	35.7
27		U	27	15	00.4	3	59.5
28	4.35	L	28	03	20.9	6	21.2
28		U	28	15	41.7	+8	39.8
29	5.35	L	29	04	02.8	10	53.9
29		U	29	16	24.4	13	02.2
Mar. 1	6.35	L	30	04	46.7	15	03.3
1		U	1	17	09.6	16	55.7
2	7.35	L	2	05	33.3	18	37.6
2		U	2	17	57.8	+20	07.3
3	8.35	L	3	06	23.2	21	22.7
3		U	3	18	49.5	22	22.0
4	9.35	L	4	07	16.7	23	03.1
4		U	4	19	44.6	23	24.1
5	10.35	L	5	08	13.2	23	23.3
5		U	5	20	42.2	+22	59.6
6	11.35	L	6	09	11.6	22	12.1
6		U	6	21	41.1	21	00.8
7	12.35	L	7	10	10.6	19	26.4
7		U	7	22	39.8	17	30.1
8	13.35	L	8	11	08.7	15	14.1
8		U	8	23	37.2	+12	40.9
9	14.35	L	9	12	05.2	9	53.7
10	15.35	U	10	00	32.9	6	55.9
10		L	10	13	00.2	+3	51.0

Date	Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
	d		d	h	m	°	'
Mar. 10		L	10	13	00.2	+3	51.0
11	16.35	U	11	01	27.2	-0	42.7
11		L	11	13	54.1	2	25.3
12	17.35	U	12	02	20.8	5	29.7
12		L	12	14	47.5	8	27.0
13	18.35	U	13	03	14.3	11	14.5
13		L	13	15	41.3	-13	49.2
14	19.35	U	14	04	08.3	16	09.0
14		L	14	16	35.6	18	11.8
15	20.35	U	15	05	03.0	19	56.0
15		L	15	17	30.5	21	20.4
16	21.35	U	16	05	58.0	22	24.2
16		L	16	18	25.5	-23	07.1
17	22.35	U	17	06	52.7	23	29.1
17		L	17	19	19.6	23	30.6
18	23.35	U	18	07	46.1	23	12.5
18		L	18	20	12.0	22	35.7
19	24.35	U	19	08	37.4	21	41.6
19		L	19	21	02.0	-20	31.7
20	25.35	U	20	09	26.1	19	07.4
20		L	20	21	49.4	17	30.3
21	26.35	U	21	10	12.2	15	42.1
21		L	21	22	34.3	13	44.2
22	27.35	U	22	10	55.9	11	38.2
22		L	22	23	17.1	-9	25.5
23	28.35	U	23	11	37.9	7	07.5
23		L	23	23	58.4	4	45.6
24	29.35	U	24	12	18.8	-2	21.0
25	0.61	L	25	00	39.0	+0	04.9
25		U	25	12	59.3	2	30.9
26	1.61	L	26	01	19.7	+4	55.7
26		U	26	13	40.2	7	18.0
27	2.61	L	27	02	01.1	9	36.5
27		U	27	14	22.4	11	49.9
28	3.61	L	28	02	44.2	13	56.6
28		U	28	15	06.5	15	55.4
29	4.61	L	29	03	29.5	+17	44.5
29		U	29	15	53.2	19	22.2
30	5.61	L	30	04	17.6	20	47.0
30		U	30	16	42.8	21	57.1
31	6.61	L	31	05	08.7	22	50.6
31		U	31	17	35.4	23	26.0
Apr. 1	7.61	L	1	06	02.6	+23	41.7
1		U	1	18	30.3	23	36.4
2	8.61	L	2	06	58.5	23	09.3
2		U	2	19	26.8	+22	19.8

MOON, 2020
AT EPHEMERIS TRANSIT

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Apr.	1	7.61	L	1	06	02.6	+23	41.7
	1		U	1	18	30.3	23	36.4
	2	8.61	L	2	06	58.5	23	09.3
	2		U	2	19	26.8	22	19.8
	3	9.61	L	3	07	55.3	21	07.9
	3		U	3	20	23.7	19	34.2
	4	10.61	L	4	08	51.9	+17	39.7
	4		U	4	21	20.0	15	26.0
	5	11.61	L	5	09	47.7	12	55.3
	5		U	5	22	15.2	10	10.0
	6	12.61	L	6	10	42.5	7	13.1
	6		U	6	23	09.6	4	07.8
	7	13.61	L	7	11	36.6	+0	57.6
	8	14.61	U	8	00	03.6	-2	14.0
	8		L	8	12	30.7	5	23.2
	9	15.61	U	9	00	58.0	8	26.5
	9		L	9	13	25.5	11	20.3
	10	16.61	U	10	01	53.3	14	01.4
	10		L	10	14	21.4	-16	26.9
	11	17.61	U	11	02	49.7	18	34.2
	11		L	11	15	18.2	20	21.3
	12	18.61	U	12	03	46.9	21	46.7
	12		L	12	16	15.5	22	49.7
	13	19.61	U	13	04	43.9	23	29.8
	13		L	13	17	12.0	-23	47.5
	14	20.61	U	14	05	39.6	23	43.4
	14		L	14	18	06.6	23	18.8
	15	21.61	U	15	06	32.9	22	35.1
	15		L	15	18	58.5	21	34.1
	16	22.61	U	16	07	23.2	20	17.5
	16		L	16	19	47.2	-18	47.0
	17	23.61	U	17	08	10.4	17	04.4
	17		L	17	20	33.0	15	11.3
	18	24.61	U	18	08	54.9	13	09.2
	18		L	18	21	16.3	10	59.7
	19	25.61	U	19	09	37.2	8	44.0
	19		L	19	21	57.8	-6	23.6
	20	26.61	U	20	10	18.2	3	59.6
	20		L	20	22	38.4	-1	33.3
	21	27.61	U	21	10	58.6	+0	54.1
	21		L	21	23	18.9	3	21.4
	22	28.61	U	22	11	39.4	5	47.2
	23	29.61	L	23	00	00.1	+8	10.2
	23		U	23	12	21.2	10	29.0
	24	0.90	L	24	00	42.7	12	42.3
	24		U	24	13	04.8	+14	48.3

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Apr.	24		U	24	13	04.8	+14	48.3
	25	1.90	L	25	01	27.5	16	45.5
	25		U	25	13	50.9	18	32.2
	26	2.90	L	26	02	14.9	20	06.7
	26		U	26	14	39.7	21	27.1
	27	3.90	L	27	03	05.1	22	31.8
	27		U	27	15	31.2	+23	19.1
	28	4.90	L	28	03	57.8	23	47.7
	28		U	28	16	24.9	23	56.3
	29	5.90	L	29	04	52.3	23	44.0
	29		U	29	17	20.0	23	10.4
	30	6.90	U	30	18	15.2	20	59.4
May	1	7.90	L	1	06	42.6	+19	23.1
	1		U	1	19	09.8	17	27.7
	2	8.90	L	2	07	36.7	15	14.9
	2		U	2	20	03.4	12	46.4
	3	9.90	L	3	08	29.8	10	04.4
	3		U	3	20	56.1	7	11.4
	4	10.90	L	4	09	22.3	+4	10.1
	4		U	4	21	48.5	+1	03.3
	5	11.90	L	5	10	14.8	-2	05.6
	5		U	5	22	41.4	5	13.6
	6	12.90	L	6	11	08.3	8	16.9
	6		U	6	23	35.7	11	12.3
	7	13.90	L	7	12	03.5	-13	56.2
	8	14.90	U	8	00	31.8	16	25.3
	8		L	8	13	00.5	18	36.7
	9	15.90	U	9	01	29.6	20	27.7
	9		L	9	13	59.0	21	56.5
	10	16.90	U	10	02	28.5	23	01.6
	10		L	10	14	57.8	-23	42.6
	11	17.90	U	11	03	26.8	23	59.5
	11		L	11	15	55.3	23	53.4
	12	18.90	U	12	04	23.1	23	25.4
	12		L	12	16	50.1	22	37.5
	13	19.90	U	13	05	16.3	21	31.5
	13		L	13	17	41.5	-20	09.6
	14	20.90	U	14	06	05.8	18	33.9
	14		L	14	18	29.2	16	46.3
	15	21.90	U	15	06	51.9	14	48.6
	15		L	15	19	13.8	12	42.6
	16	22.90	U	16	07	35.2	10	29.6
	16		L	16	19	56.1	-8	11.1
	17	23.90	U	17	08	16.7	5	48.4
	17		L	17	20	37.0	3	22.7
	18	24.90	U	18	08	57.2	-0	55.1

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Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
May	18	24.90	U	18	08	57.2	-0	55.1
	18		L	18	21	17.4	+1	33.2
	19	25.90	U	19	09	37.6	4	01.0
	19		L	19	21	58.2	6	27.2
	20	26.90	U	20	10	19.0	8	50.3
	20		L	20	22	40.3	11	09.0
	21	27.90	U	21	11	02.1	+13	21.9
	21		L	21	23	24.5	15	27.1
	22	28.90	U	22	11	47.6	17	23.1
	23	0.26	L	23	00	11.4	19	07.9
	23		U	23	12	35.9	20	39.7
	24	1.26	L	24	01	01.3	21	56.5
	24		U	24	13	27.2	+22	56.6
	25	2.26	L	25	01	53.9	23	38.3
	25		U	25	14	20.9	24	00.2
	26	3.26	L	26	02	48.4	24	01.3
	26		U	26	15	16.0	23	41.0
	27	4.26	L	27	03	43.7	22	59.2
	27		U	27	16	11.3	+21	56.3
	28	5.26	L	28	04	38.6	20	33.1
	28		U	28	17	05.6	18	50.7
	29	6.26	L	29	05	32.2	16	50.8
	29		U	29	17	58.4	14	35.1
	30	7.26	L	30	06	24.3	12	05.6
	30		U	30	18	49.8	+9	24.5
	31	8.26	L	31	07	15.2	6	34.0
	31		U	31	19	40.4	3	36.6
June	1	9.26	L	1	08	05.7	+0	34.8
	1		U	1	20	31.1	-2	28.7
	2	10.26	L	2	08	56.8	5	31.0
	2		U	2	21	22.8	-8	29.2
	3	11.26	L	3	09	49.4	11	20.1
	3		U	3	22	16.5	14	00.6
	4	12.26	L	4	10	44.3	16	27.6
	4		U	4	23	12.7	18	38.0
	5	13.26	L	5	11	41.6	20	29.0
	6	14.26	U	6	00	10.9	-21	58.4
	6		L	6	12	40.5	23	04.5
	7	15.26	U	7	01	10.1	23	46.4
	7		L	7	13	39.5	24	03.7
	8	16.26	U	8	02	08.5	23	57.1
	8		L	8	14	36.9	23	28.0
	9	17.26	U	9	03	04.5	-22	37.9
	9		L	9	15	31.1	21	29.2
	10	18.26	U	10	03	56.8	20	03.8
	10		L	10	16	21.6	-18	24.4
June	10		L	10	16	21.6	-18	24.4
	11	19.26	U	11	04	45.4	16	32.9
	11		L	11	17	08.3	14	31.5
	12	20.26	U	12	05	30.6	12	21.9
	12		L	12	17	52.1	10	05.9
	13	21.26	U	13	06	13.2	7	44.9
	13		L	13	18	33.8	-5	20.2
	14	22.26	U	14	06	54.1	2	53.0
	14		L	14	19	14.4	-0	24.6
	15	23.26	U	15	07	34.5	+2	04.1
	15		L	15	19	54.8	4	31.8
	16	24.26	U	16	08	15.4	6	57.5
	16		L	16	20	36.3	+9	19.9
	17	25.26	U	17	08	57.6	11	37.6
	17		L	17	21	19.5	13	49.2
	18	26.26	U	18	09	42.1	15	53.0
	18		L	18	22	05.4	17	47.3
	19	27.26	U	19	10	29.6	19	30.1
	19		L	19	22	54.5	+20	59.5
	20	28.26	U	20	11	20.3	22	13.4
	20		L	20	23	46.8	23	09.8
	21	29.26	U	21	12	13.9	23	47.0
	22	0.72	L	22	00	41.6	24	03.5
	22		U	22	13	09.7	23	58.1
	23	1.72	L	23	01	37.9	+23	30.5
	23		U	23	14	06.0	22	40.7
	24	2.72	L	24	02	34.0	21	29.4
	24		U	24	15	01.6	19	57.7
	25	3.72	L	25	03	28.7	18	07.2
	25		U	25	15	55.4	15	59.9
	26	4.72	L	26	04	21.5	+13	38.0
	26		U	26	16	47.2	11	03.8
	27	5.72	L	27	05	12.5	8	19.6
	27		U	27	17	37.5	5	28.0
	28	6.72	L	28	06	02.3	+2	31.3
	28		U	28	18	27.1	-0	28.0
	29	7.72	L	29	06	52.0	-3	27.3
	29		U	29	19	17.0	6	24.1
	30	8.72	L	30	07	42.5	9	15.8
	30		U	30	20	08.3	11	59.7
July	1	9.72	L	1	08	34.8	14	33.0
	1		U	1	21	01.8	16	52.9
	2	10.72	L	2	09	29.5	-18	56.9
	2		U	2	21	57.7	20	42.3
	3	11.72	L	3	10	26.5	22	07.1
	3		U	3	22	55.6	-23	09.6

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Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
July	1	9.72	L	1	08	34.8	-14	33.0
	1		U	1	21	01.8	16	52.9
	2	10.72	L	2	09	29.5	18	56.9
	2		U	2	21	57.7	20	42.3
	3	11.72	L	3	10	26.5	22	07.1
	3		U	3	22	55.6	23	09.6
	4	12.72	L	4	11	24.8	-23	48.6
	4		U	4	23	53.9	24	03.7
	5	13.72	L	5	12	22.8	23	55.3
	6	14.72	U	6	00	51.1	23	24.3
	6		L	6	13	18.7	22	32.4
	7	15.72	U	7	01	45.5	21	21.4
	7		L	7	14	11.4	-19	53.8
	8	16.72	U	8	02	36.3	18	11.6
	8		L	8	15	00.3	16	17.3
	9	17.72	U	9	03	23.5	14	13.0
	9		L	9	15	45.9	12	00.6
	10	18.72	U	10	04	07.7	9	42.0
	10		L	10	16	28.9	-7	18.7
	11	19.72	U	11	04	49.6	4	52.1
	11		L	11	17	10.1	-2	23.7
	12	20.72	U	12	05	30.3	+0	05.5
	12		L	12	17	50.6	2	34.4
	13	21.72	U	13	06	10.9	5	01.7
	13		L	13	18	31.4	+7	26.4
	14	22.72	U	14	06	52.2	9	47.4
	14		L	14	19	13.6	12	03.2
	15	23.72	U	15	07	35.4	14	12.7
	15		L	15	19	58.0	16	14.2
	16	24.72	U	16	08	21.3	18	06.0
	16		L	16	20	45.4	+19	46.2
	17	25.72	U	17	09	10.4	21	12.9
	17		L	17	21	36.3	22	24.0
	18	26.72	U	18	10	03.0	23	17.4
	18		L	18	22	30.5	23	51.3
	19	27.72	U	19	10	58.5	24	04.0
	19		L	19	23	26.9	+23	54.3
	20	28.72	U	20	11	55.6	23	21.5
	21	0.27	L	21	00	24.3	22	25.7
	21		U	21	12	52.8	21	07.5
	22	1.27	L	22	01	21.0	19	28.3
	22		U	22	13	48.7	17	29.9
	23	2.27	L	23	02	15.8	+15	14.4
	23		U	23	14	42.5	12	44.5
	24	3.27	L	24	03	08.6	10	02.9
	24		U	24	15	34.3	+7	12.4
July	24		U	24	15	34.3	+7	12.4
	25	4.27	L	25	03	59.6	4	15.6
	25		U	25	16	24.6	+1	15.5
	26	5.27	L	26	04	49.6	-1	45.4
	26		U	26	17	14.6	4	44.5
	27	6.27	L	27	05	39.7	7	39.0
	27		U	27	18	05.1	-10	26.6
	28	7.27	L	28	06	30.8	13	04.7
	28		U	28	18	57.1	15	30.8
	29	8.27	L	29	07	23.8	17	42.6
	29		U	29	19	51.1	19	37.8
	30	9.27	L	30	08	18.8	21	14.3
	30		U	30	20	47.0	-22	30.4
	31	10.27	L	31	09	15.5	23	24.7
	31		U	31	21	44.0	23	56.4
Aug.	1	11.27	L	1	10	12.5	24	05.2
	1		U	1	22	40.8	23	51.4
	2	12.27	L	2	11	08.5	23	15.9
	2		U	2	23	35.7	-22	20.2
	3	13.27	L	3	12	02.1	21	06.0
	4	14.27	U	4	00	27.6	19	35.4
	4		L	4	12	52.3	17	50.6
	5	15.27	U	5	01	16.2	15	53.7
	5		L	5	13	39.3	13	46.9
	6	16.27	U	6	02	01.7	-11	32.1
	6		L	6	14	23.4	9	11.2
	7	17.27	U	7	02	44.7	6	45.9
	7		L	7	15	05.5	4	17.6
	8	18.27	U	8	03	26.0	-1	47.8
	8		L	8	15	46.3	+0	42.3
	9	19.27	U	9	04	06.5	+3	11.5
	9		L	9	16	26.9	5	38.6
	10	20.27	U	10	04	47.4	8	02.4
	10		L	10	17	08.2	10	21.9
	11	21.27	U	11	05	29.4	12	35.7
	11		L	11	17	51.2	14	42.6
	12	22.27	U	12	06	13.5	+16	41.1
	12		L	12	18	36.7	18	29.7
	13	23.27	U	13	07	00.6	20	06.5
	13		L	13	19	25.4	21	29.8
	14	24.27	U	14	07	51.0	22	37.6
	14		L	14	20	17.4	23	28.0
	15	25.27	U	15	08	44.6	+23	59.0
	15		L	15	21	12.5	24	09.1
	16	26.27	U	16	09	40.9	23	56.7
	16		L	16	22	09.6	+23	21.3

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Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Aug.	16		L	16	22	09.6	+23	21.3
	17	27.27	U	17	10	38.4	22	22.4
	17		L	17	23	07.1	21	00.6
	18	28.27	U	18	11	35.7	19	17.0
	19	29.27	L	19	00	03.8	17	13.2
	19		U	19	12	31.5	14	51.6
	20	0.89	L	20	00	58.8	+12	14.8
	20		U	20	13	25.5	9	25.7
	21	1.89	L	21	01	51.9	6	27.5
	21		U	21	14	17.9	3	23.4
	22	2.89	L	22	02	43.8	+0	16.5
	22		U	22	15	09.5	-2	50.0
	23	3.89	L	23	03	35.2	-5	53.2
	23		U	23	16	01.0	8	50.1
	24	4.89	L	24	04	27.0	11	38.0
	24		U	24	16	53.4	14	14.3
	25	5.89	L	25	05	20.1	16	36.5
	25		U	25	17	47.2	18	42.4
	26	6.89	L	26	06	14.7	-20	30.1
	26		U	26	18	42.5	21	57.9
	27	7.89	L	27	07	10.7	23	04.5
	27		U	27	19	38.9	23	48.9
	28	8.89	L	28	08	07.1	24	10.8
	28		U	28	20	35.1	24	10.4
	29	9.89	L	29	09	02.7	-23	48.2
	29		U	29	21	29.8	23	05.4
	30	10.89	L	30	09	56.3	22	03.4
	30		U	30	22	22.0	20	44.0
	31	11.89	L	31	10	47.0	19	09.0
	31		U	31	23	11.2	17	20.6
Sept.	1	12.89	L	1	11	34.6	-15	20.7
	1		U	1	23	57.3	13	11.3
	2	13.89	L	2	12	19.3	10	54.2
	3	14.89	U	3	00	40.9	8	31.2
	3		L	3	13	01.9	6	04.0
	4	15.89	U	4	01	22.6	3	34.1
	4		L	4	13	43.0	-1	02.9
	5	16.89	U	5	02	03.3	+1	28.3
	5		L	5	14	23.6	3	58.1
	6	17.89	U	6	02	43.9	6	25.3
	6		L	6	15	04.5	8	48.8
	7	18.89	U	7	03	25.3	11	07.2
	7		L	7	15	46.5	+13	19.3
	8	19.89	U	8	04	08.2	15	23.8
	8		L	8	16	30.5	17	19.3
	9	20.89	U	9	04	53.4	+19	04.3

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Sept.	9	20.89	U	9	04	53.4	+19	04.3
	9		L	9	17	17.1	20	37.3
	10	21.89	U	10	05	41.6	21	56.4
	10		L	10	18	06.8	23	00.0
	11	22.89	U	11	06	32.8	23	46.5
	11		L	11	18	59.5	24	14.0
	12	23.89	U	12	07	26.8	+24	21.0
	12		L	12	19	54.6	24	06.5
	13	24.89	U	13	08	22.7	23	29.5
	13		L	13	20	51.0	22	29.6
	14	25.89	U	14	09	19.3	21	07.2
	14		L	14	21	47.6	19	22.8
	15	26.89	U	15	10	15.6	+17	18.0
	15		L	15	22	43.3	14	54.5
	16	27.89	U	16	11	10.7	12	14.9
	16		L	16	23	37.8	9	21.9
	17	28.89	U	17	12	04.6	6	18.6
	18	0.54	L	18	00	31.2	+3	08.3
	18		U	18	12	57.7	-0	05.5
	19	1.54	L	19	01	24.2	3	19.1
	19		U	19	13	50.8	6	29.2
	20	2.54	L	20	02	17.6	9	32.3
	20		U	20	14	44.7	12	25.0
	21	3.54	L	21	03	12.1	15	04.5
	21		U	21	15	39.9	-17	27.8
	22	4.54	L	22	04	08.0	19	32.7
	22		U	22	16	36.4	21	17.1
	23	5.54	L	23	05	05.0	22	39.5
	23		U	23	17	33.7	23	38.9
	24	6.54	L	24	06	02.4	24	14.9
	24		U	24	18	30.8	-24	27.6
	25	7.54	L	25	06	58.8	24	17.6
	25		U	25	19	26.3	23	46.2
	26	8.54	L	26	07	53.1	22	54.8
	26		U	26	20	19.1	21	45.1
	27	9.54	L	27	08	44.3	20	18.9
	27		U	27	21	08.7	-18	38.4
	28	10.54	L	28	09	32.3	16	45.3
	28		U	28	21	55.2	14	41.6
	29	11.54	L	29	10	17.4	12	29.2
	29		U	29	22	39.1	10	09.7
	30	12.54	L	30	11	00.2	7	44.7
	30		U	30	23	21.0	-5	15.8
Oct.	1	13.54	L	1	11	41.4	2	44.5
	2	14.54	U	2	00	01.7	-0	12.2
	2		L	2	12	22.0	+2	19.9

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Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Oct.	1	13.54	L	1	11	41.4	-2	44.5
	2	14.54	U	2	00	01.7	-0	12.2
	2		L	2	12	22.0	+2	19.9
	3	15.54	U	3	00	42.2	4	50.4
	3		L	3	13	02.6	7	17.9
	4	16.54	U	4	01	23.2	9	41.3
	4		L	4	13	44.1	+11	59.1
	5	17.54	U	5	02	05.4	14	10.0
	5		L	5	14	27.2	16	12.6
	6	18.54	U	6	02	49.6	18	05.5
	6		L	6	15	12.6	19	47.1
	7	19.54	U	7	03	36.3	21	16.0
	7		L	7	16	00.6	+22	30.5
	8	20.54	U	8	04	25.7	23	29.2
	8		L	8	16	51.3	24	10.4
	9	21.54	U	9	05	17.5	24	32.9
	9		L	9	17	44.2	24	35.5
	10	22.54	U	10	06	11.3	24	17.3
	10		L	10	18	38.6	+23	37.6
	11	23.54	U	11	07	06.0	22	36.3
	11		L	11	19	33.4	21	13.5
	12	24.54	U	12	08	00.8	19	30.0
	12		L	12	20	27.9	17	26.8
	13	25.54	U	13	08	54.9	15	05.4
	13		L	13	21	21.7	+12	27.8
	14	26.54	U	14	09	48.3	9	36.2
	14		L	14	22	14.8	6	33.4
	15	27.54	U	15	10	41.3	3	22.4
	15		L	15	23	07.8	+0	06.4
	16	28.54	U	16	11	34.6	-3	11.0
	17	0.19	L	17	00	01.6	-6	26.1
	17		U	17	12	28.9	9	35.1
	18	1.19	L	18	00	56.8	12	34.3
	18		U	18	13	25.0	15	19.9
	19	2.19	L	19	01	53.9	17	48.6
	19		U	19	14	23.1	19	57.3
	20	3.19	L	20	02	52.7	-21	43.8
	20		U	20	15	22.5	23	06.1
	21	4.19	L	21	03	52.4	24	03.3
	21		U	21	16	22.0	24	35.1
	22	5.19	L	22	04	51.3	24	41.9
	22		U	22	17	20.0	24	24.9
	23	6.19	L	23	05	47.9	-23	45.8
	23		U	23	18	15.0	22	46.5
	24	7.19	L	24	06	41.1	21	29.1
	24		U	24	19	06.2	-19	56.0

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Oct.	24		U	24	19	06.2	-19	56.0
	25	8.19	L	25	07	30.5	18	09.2
	25		U	25	19	53.8	16	10.9
	26	9.19	L	26	08	16.4	14	02.8
	26		U	26	20	38.3	11	46.9
	27	10.19	L	27	08	59.6	9	24.7
	27		U	27	21	20.5	-6	57.8
	28	11.19	L	28	09	41.0	4	27.4
	28		U	28	22	01.2	-1	55.1
	29	12.19	L	29	10	21.4	+0	38.0
	29		U	29	22	41.5	3	10.4
	30	13.19	L	30	11	01.7	5	41.1
	30		U	30	23	22.1	+8	08.6
	31	14.19	L	31	11	42.8	10	31.7
Nov.	1	15.19	U	1	00	03.9	12	48.8
	1		L	1	12	25.4	14	58.6
	2	16.19	U	2	00	47.5	16	59.6
	2		L	2	13	10.2	18	50.2
	3	17.19	U	3	01	33.5	+20	28.7
	3		L	3	13	57.5	21	53.7
	4	18.19	U	4	02	22.0	23	03.5
	4		L	4	14	47.2	23	56.6
	5	19.19	U	5	03	12.9	24	31.8
	5		L	5	15	39.1	24	47.9
	6	20.19	U	6	04	05.5	+24	44.1
	6		L	6	16	32.2	24	19.8
	7	21.19	U	7	04	58.9	23	34.8
	7		L	7	17	25.6	22	29.3
	8	22.19	U	8	05	52.2	21	03.8
	8		L	8	18	18.5	19	19.1
	9	23.19	U	9	06	44.7	+17	16.4
	9		L	9	19	10.5	14	57.2
	10	24.19	U	10	07	36.2	12	23.0
	10		L	10	20	01.8	9	35.8
	11	25.19	U	11	08	27.3	6	37.8
	11		L	11	20	52.9	3	31.5
	12	26.19	U	12	09	18.6	+0	19.6
	12		L	12	21	44.7	-2	54.8
	13	27.19	U	13	10	11.2	6	08.4
	13		L	13	22	38.2	9	17.7
	14	28.19	U	14	11	05.8	12	18.8
	14		L	14	23	34.2	15	07.9
	15	29.19	U	15	12	03.3	-17	41.0
	16	0.79	L	16	00	33.1	19	54.9
	16		U	16	13	03.3	21	46.1
	17	1.79	L	17	01	34.1	-23	12.4

MOON, 2020
AT EPHEMERIS TRANSIT

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination		Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'			d		d	h	m	°	'
Nov.	17	1.79	L	17	01	34.1	-23	12.4	Dec.	10	24.79	U	10	07	59.4	-3	10.6
	17		U	17	14	04.9	24	12.1		10		L	10	20	24.9	6	17.4
	18	2.79	L	18	02	35.7	24	44.6		11	25.79	U	11	08	50.9	9	20.4
	18		U	18	15	06.0	24	50.4		11		L	11	21	17.7	12	16.3
	19	3.79	L	19	03	35.7	24	30.6		12	26.79	U	12	09	45.2	15	01.7
	19		U	19	16	04.6	23	47.3		12		L	12	22	13.6	17	33.0
	20	4.79	L	20	04	32.5	-22	42.6		13	27.79	U	13	10	42.8	-19	46.4
	20		U	20	16	59.3	21	19.4		13		L	13	23	12.9	21	38.9
	21	5.79	L	21	05	24.9	19	40.2		14	28.79	U	14	11	43.5	23	07.3
	21		U	21	17	49.5	17	47.5		15	0.32	L	15	00	14.5	24	09.7
	22	6.79	L	22	06	13.1	15	43.7		15		U	15	12	45.6	24	44.7
	22		U	22	18	35.8	13	31.0		16	1.32	L	16	01	16.6	24	52.2
	23	7.79	L	23	06	57.8	-11	11.1		16		U	16	13	47.0	-24	33.0
	23		U	23	19	19.1	8	45.8		17	2.32	L	17	02	16.6	23	48.8
	24	8.79	L	24	07	39.8	6	16.5		17		U	17	14	45.3	22	42.1
	24		U	24	20	00.3	3	44.6		18	3.32	L	18	03	12.8	21	15.6
	25	9.79	L	25	08	20.4	-1	11.3		18		U	18	15	39.3	19	32.4
	25		U	25	20	40.5	+1	22.1		19	4.32	L	19	04	04.5	17	35.1
	26	10.79	L	26	09	00.6	+3	54.5		19		U	19	16	28.7	-15	26.6
	26		U	26	21	20.8	6	24.8		20	5.32	L	20	04	51.9	13	09.2
	27	11.79	L	27	09	41.2	8	51.5		20		U	20	17	14.2	10	45.1
	27		U	27	22	02.0	11	13.6		21	6.32	L	21	05	35.8	8	16.1
	28	12.79	L	28	10	23.2	13	29.4		21		U	21	17	56.8	5	43.8
	28		U	28	22	45.0	15	37.7		22	7.32	L	22	06	17.4	3	09.7
	29	13.79	L	29	11	07.3	+17	36.7		22		U	22	18	37.7	-0	34.9
	29		U	29	23	30.4	19	24.9		23	8.32	L	23	06	57.9	+1	59.2
	30	14.79	L	30	11	54.1	21	00.5		23		U	23	19	18.0	4	31.7
Dec.	1	15.79	U	1	00	18.5	22	21.8		24	9.32	L	24	07	38.2	7	01.3
	1		L	1	12	43.6	23	27.0		24		U	24	19	58.7	9	26.9
	2	16.79	U	2	01	09.2	24	14.9		25	10.32	L	25	08	19.6	11	47.4
	2		L	2	13	35.3	+24	43.8		25		U	25	20	40.9	+14	01.4
	3	17.79	U	3	02	01.8	24	53.0		26	11.32	L	26	09	02.8	16	07.4
	3		L	3	14	28.5	24	41.6		26		U	26	21	25.3	18	03.9
	4	18.79	U	4	02	55.3	24	09.5		27	12.32	L	27	09	48.5	19	49.3
	4		L	4	15	21.9	23	16.8		27		U	27	22	12.5	21	21.8
	5	19.79	U	5	03	48.4	22	04.2		28	13.32	L	28	10	37.2	22	39.6
	5		L	5	16	14.6	+20	32.4		28		U	28	23	02.6	+23	40.9
	6	20.79	U	6	04	40.5	18	42.8		29	14.32	L	29	11	28.7	24	24.0
	6		L	6	17	05.9	16	36.8		29		U	29	23	55.4	24	47.7
	7	21.79	U	7	05	31.1	14	16.0		30	15.32	L	30	12	22.3	24	50.7
	7		L	7	17	55.9	11	42.2		31	16.32	U	31	00	49.5	24	32.4
	8	22.79	U	8	06	20.6	8	57.3		31		L	31	13	16.7	23	52.6
	8		L	8	18	45.1	+6	03.3		32	17.32	U	32	01	43.8	+22	51.8
	9	23.79	U	9	07	09.7	+3	02.4		32		L	32	14	10.6	21	30.7
	9		L	9	19	34.4	-0	03.1		33	18.32	U	33	02	37.1	19	50.5
	10	24.79	U	10	07	59.4	-3	10.6		33		L	33	15	03.1	+17	52.9

MOON, 2020
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date 0^h TT		The Earth's Selenographic Long.	The Earth's Selenographic Lat.	The Sun's Selenographic Colong.	The Sun's Selenographic Lat.	Position Angle of Axis	Position Angle of Bright Limb	Fraction Illuminated
		°	°	°	°	°	°	
Jan.	0	+1.968	+5.711	323.26	-0.04	337	251	0.216
	1	+0.773	6.382	335.43	0.06	336	249	0.299
	2	-0.495	6.777	347.61	0.07	336	248	0.389
	3	1.767	6.884	359.77	0.09	337	247	0.483
	4	2.970	6.697	11.93	0.10	339	247	0.577
	5	4.031	6.215	24.08	0.12	341	249	0.670
	6	-4.879	5.444	36.22	-0.14	345	251	0.759
	7	5.455	4.398	48.36	0.16	349	254	0.839
	8	5.709	3.106	60.50	0.19	354	259	0.908
	9	5.614	+1.615	72.63	0.22	359	265	0.960
	10	5.164	-0.002	84.75	0.25	5	274	0.992
	11	4.383	1.654	96.88	0.29	11	72	0.999
	12	-3.320	-3.230	109.00	-0.32	16	96	0.981
	13	2.055	4.617	121.13	0.36	20	103	0.936
	14	-0.680	5.711	133.26	0.40	23	107	0.867
	15	+0.701	6.434	145.40	0.44	24	110	0.778
	16	1.997	6.740	157.54	0.48	23	111	0.674
	17	3.131	6.621	169.69	0.51	22	111	0.563
	18	+4.050	-6.101	181.84	-0.55	19	110	0.449
	19	4.728	5.229	194.01	0.59	15	108	0.341
	20	5.156	4.072	206.18	0.62	10	104	0.241
	21	5.341	2.706	218.36	0.65	5	99	0.155
	22	5.297	-1.215	230.54	0.69	360	93	0.087
	23	5.039	+0.316	242.72	0.72	354	85	0.037
	24	+4.582	+1.810	254.91	-0.74	349	73	0.008
	25	3.940	3.194	267.10	0.77	344	321	0.001
	26	3.126	4.407	279.30	0.79	341	267	0.013
	27	2.157	5.402	291.49	0.81	338	258	0.043
	28	+1.052	6.145	303.67	0.82	337	254	0.091
	29	-0.157	6.614	315.86	0.84	336	251	0.152
	30	-1.433	+6.797	328.04	-0.85	337	250	0.226
	31	2.723	6.692	340.21	0.86	338	250	0.309
Feb.	1	3.966	6.300	352.38	0.87	340	251	0.399
	2	5.091	5.630	04.55	0.89	343	252	0.495
	3	6.021	4.697	16.71	0.90	347	255	0.592
	4	6.677	3.524	28.86	0.91	352	259	0.688
	5	-6.985	+2.143	41.01	-0.93	357	264	0.779
	6	6.882	+0.609	53.15	0.95	3	271	0.861
	7	6.332	-1.005	65.28	0.97	9	278	0.928
	8	5.335	2.603	77.41	0.99	14	289	0.976
	9	3.937	4.069	89.54	1.02	19	323	0.998
	10	2.236	5.285	101.67	1.04	22	88	0.992
	11	-0.374	-6.144	113.81	-1.07	24	102	0.957
	12	+1.487	6.577	125.94	1.10	24	107	0.895
	13	3.187	6.558	138.08	1.13	22	109	0.812
	14	4.601	6.110	150.22	1.15	20	108	0.713
	15	+5.650	-5.288	162.38	-1.18	16	106	0.604

MOON, 2020
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date 0^h TT		The Earth's Selenographic		The Sun's Selenographic		Position Angle of		Fraction Illuminated
		Long.	Lat.	Colong.	Lat.	Axis	Bright Limb	
		°	°	°	°	°	°	
Feb.	15	+5.650	-5.288	162.38	-1.18	16	106	0.604
	16	6.308	4.172	174.54	1.21	12	103	0.493
	17	6.586	2.847	186.71	1.23	6	98	0.386
	18	6.524	-1.399	198.88	1.26	1	93	0.286
	19	6.177	+0.092	211.06	1.28	355	87	0.197
	20	5.598	1.552	223.25	1.31	350	80	0.123
	21	+4.836	+2.917	235.45	-1.33	345	73	0.066
	22	3.932	4.128	247.64	1.35	342	64	0.026
	23	2.913	5.139	259.84	1.37	339	41	0.005
	24	1.801	5.911	272.04	1.38	337	297	0.003
	25	+0.612	6.417	284.24	1.39	336	264	0.019
	26	-0.638	6.643	296.44	1.40	336	257	0.052
	27	-1.926	+6.584	308.64	-1.40	338	254	0.101
	28	3.221	6.243	320.83	1.41	340	253	0.164
	29	4.480	5.633	333.02	1.41	342	254	0.239
Mar.	1	5.645	4.772	345.21	1.41	346	256	0.325
	2	6.646	3.684	357.39	1.41	350	259	0.419
	3	7.401	2.404	9.56	1.41	355	264	0.518
	4	-7.827	+0.973	21.73	-1.41	0	269	0.620
	5	7.841	-0.551	33.89	1.42	6	275	0.720
	6	7.378	2.092	46.05	1.42	12	282	0.813
	7	6.407	3.555	58.20	1.43	17	289	0.893
	8	4.947	4.830	70.34	1.44	21	298	0.954
	9	3.081	5.803	82.48	1.44	23	315	0.990
	10	-0.957	-6.376	94.63	-1.45	24	61	0.997
	11	+1.231	6.491	106.77	1.46	23	98	0.974
	12	3.276	6.142	118.91	1.47	21	104	0.922
	13	5.005	5.376	131.06	1.48	17	104	0.846
	14	6.301	4.278	143.22	1.49	13	102	0.754
	15	7.115	2.948	155.38	1.50	8	99	0.651
	16	+7.453	-1.489	167.56	-1.52	2	94	0.544
	17	7.365	+0.010	179.73	1.53	357	88	0.438
	18	6.921	1.470	191.92	1.54	351	82	0.338
	19	6.197	2.828	204.11	1.55	346	77	0.247
	20	5.266	4.033	216.31	1.57	342	71	0.168
	21	4.191	5.039	228.52	1.58	339	65	0.103
	22	+3.022	+5.814	240.73	-1.58	337	59	0.053
	23	1.793	6.331	252.94	1.59	336	50	0.019
	24	+0.530	6.572	265.15	1.59	336	17	0.003
	25	-0.749	6.530	277.37	1.59	337	284	0.005
	26	2.028	6.207	289.59	1.59	339	263	0.025
	27	3.287	5.615	301.80	1.58	342	259	0.062
	28	-4.499	4.775	314.01	-1.57	345	258	0.115
	29	5.622	3.716	326.22	1.56	349	260	0.183
	30	6.602	2.475	338.42	1.55	354	263	0.264
	31	7.372	+1.096	350.62	1.54	359	268	0.356
Apr.	1	-7.854	-0.367	2.82	-1.53	4	273	0.456

MOON, 2020
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date 0^h TT		The Earth's Selenographic Long.	The Earth's Selenographic Lat.	The Sun's Selenographic Colong.	The Sun's Selenographic Lat.	Position Angle of Axis	Position Angle of Bright Limb	Fraction Illuminated
		°	°	°	°	°	°	
Apr.	1	-7.854	-0.367	2.82	-1.53	4	273	0.456
	2	7.968	1.850	15.00	1.51	10	279	0.562
	3	7.643	3.275	27.18	1.50	15	284	0.668
	4	6.830	4.551	39.36	1.49	19	290	0.769
	5	5.524	5.578	51.52	1.48	22	296	0.859
	6	3.779	6.257	63.69	1.47	24	301	0.931
	7	-1.717	-6.509	75.85	-1.45	24	311	0.979
	8	+0.485	6.294	88.00	1.44	22	5	0.998
	9	2.621	5.627	100.16	1.44	19	91	0.986
	10	4.498	4.572	112.32	1.43	15	99	0.946
	11	5.971	3.234	124.49	1.42	10	98	0.880
	12	6.961	1.728	136.66	1.41	4	95	0.797
	13	+7.450	-0.166	148.84	-1.41	358	90	0.701
	14	7.472	+1.358	161.02	1.41	353	85	0.599
	15	7.088	2.769	173.21	1.40	348	79	0.497
	16	6.377	4.012	185.41	1.40	343	74	0.397
	17	5.421	5.046	197.62	1.40	340	69	0.304
	18	4.295	5.842	209.83	1.40	338	66	0.220
	19	+3.065	+6.376	222.05	-1.40	337	62	0.147
	20	1.783	6.634	234.27	1.40	336	59	0.087
	21	+0.490	6.609	246.50	1.39	337	55	0.042
	22	-0.784	6.300	258.73	1.38	339	47	0.013
	23	2.017	5.717	270.96	1.37	341	355	0.002
	24	3.187	4.880	283.19	1.36	344	273	0.009
	25	-4.276	3.818	295.42	-1.34	348	264	0.034
	26	5.253	2.572	307.65	1.32	352	264	0.078
	27	6.084	+1.189	319.88	1.30	358	267	0.139
	28	6.722	-0.272	332.10	1.27	3	271	0.216
	29	7.111	1.748	344.32	1.25	8	276	0.307
	30	7.192	3.164	356.53	1.22	14	282	0.408
May	1	-6.910	-4.442	8.74	-1.20	18	287	0.517
	2	6.224	5.496	20.93	1.17	21	291	0.627
	3	5.126	6.241	33.13	1.15	23	295	0.734
	4	3.650	6.600	45.31	1.12	24	298	0.831
	5	-1.883	6.521	57.49	1.09	23	300	0.911
	6	+0.040	5.990	69.67	1.07	21	303	0.967
	7	+1.956	-5.040	81.84	-1.04	17	320	0.996
	8	3.699	3.749	94.02	1.01	12	83	0.995
	9	5.130	2.230	106.20	0.99	7	94	0.966
	10	6.154	-0.603	118.37	0.97	1	92	0.912
	11	6.729	+1.014	130.56	0.95	355	87	0.839
	12	6.860	2.529	142.75	0.93	349	82	0.752
	13	+6.585	+3.870	154.95	-0.92	345	77	0.657
	14	5.964	4.988	167.15	0.90	341	72	0.559
	15	5.069	5.852	179.36	0.89	338	69	0.461
	16	3.975	6.443	191.58	0.88	337	66	0.366
	17	+2.755	+6.749	203.80	-0.87	336	64	0.277

MOON, 2020
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date 0^h TT		The Earth's Selenographic Long.	The Earth's Selenographic Lat.	The Sun's Selenographic Colong.	The Sun's Selenographic Lat.	Position Angle of Axis	Position Angle of Bright Limb	Fraction Illuminated
		°	°	°	°	°	°	
May	17	+2.755	+6.749	203.80	-0.87	336	64	0.277
	18	1.474	6.766	216.03	0.86	337	63	0.197
	19	+0.190	6.495	228.26	0.85	338	62	0.127
	20	-1.050	5.945	240.50	0.84	340	62	0.071
	21	2.207	5.131	252.74	0.82	343	61	0.030
	22	3.252	4.081	264.99	0.80	347	55	0.006
	23	-4.158	+2.830	277.23	-0.78	351	295	0.001
	24	4.904	+1.429	289.48	0.76	356	269	0.016
	25	5.468	-0.061	301.72	0.73	2	270	0.052
	26	5.824	1.572	313.96	0.70	7	274	0.107
	27	5.948	3.025	326.20	0.67	12	279	0.181
	28	5.815	4.340	338.43	0.64	17	284	0.271
	29	-5.403	-5.435	350.66	-0.61	20	288	0.374
	30	4.704	6.235	2.88	0.57	23	292	0.485
	31	3.725	6.674	15.09	0.54	24	294	0.598
June	1	2.500	6.703	27.30	0.50	23	296	0.709
	2	-1.092	6.303	39.49	0.47	21	296	0.809
	3	+0.412	5.486	51.69	0.43	18	295	0.893
	4	+1.904	-4.306	63.88	-0.39	14	293	0.955
	5	3.273	2.850	76.07	0.36	9	292	0.991
	6	4.420	-1.229	88.25	0.32	3	75	0.999
	7	5.265	+0.439	100.44	0.29	357	90	0.981
	8	5.759	2.045	112.63	0.26	352	86	0.939
	9	5.886	3.498	124.83	0.23	346	81	0.878
	10	+5.654	+4.732	137.02	-0.21	342	76	0.802
	11	5.098	5.705	149.23	0.19	339	72	0.715
	12	4.268	6.391	161.44	0.17	337	69	0.623
	13	3.225	6.782	173.65	0.16	336	67	0.527
	14	2.038	6.874	185.88	0.14	337	66	0.432
	15	+0.778	6.673	198.10	0.13	338	65	0.339
	16	-0.488	+6.188	210.34	-0.12	340	66	0.252
	17	1.694	5.435	222.58	0.10	342	68	0.174
	18	2.782	4.435	234.82	0.09	346	70	0.107
	19	3.704	3.220	247.07	0.07	350	74	0.054
	20	4.419	1.834	259.32	0.05	355	78	0.017
	21	4.900	+0.334	271.57	-0.03	0	85	0.001
	22	-5.129	-1.210	283.82	0.00	6	268	0.006
	23	5.101	2.715	296.07	+0.03	11	274	0.034
	24	4.823	4.094	308.32	0.06	16	280	0.084
	25	4.311	5.260	320.57	0.09	20	285	0.156
	26	3.593	6.131	332.81	0.12	22	289	0.245
	27	2.703	6.644	345.04	0.16	24	292	0.349
	28	-1.685	-6.757	357.27	+0.19	23	293	0.462
	29	-0.586	6.455	9.49	0.23	22	293	0.577
	30	+0.542	5.750	21.70	0.27	19	292	0.688
July	1	1.647	4.687	33.91	0.31	16	289	0.790
	2	+2.674	-3.336	46.11	+0.35	11	285	0.875

MOON, 2020
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date 0^h TT		The Earth's Selenographic Long.	The Earth's Selenographic Lat.	The Sun's Selenographic Colong.	The Sun's Selenographic Lat.	Position Angle of Axis	Position Angle of Bright Limb	Fraction Illuminated
		°	°	°	°	°	°	
July	1	+1.647	-4.687	33.91	+0.31	16	289	0.790
	2	2.674	3.336	46.11	0.35	11	285	0.875
	3	3.572	1.789	58.31	0.39	6	280	0.941
	4	4.293	-0.151	70.50	0.42	360	272	0.982
	5	4.793	+1.473	82.70	0.46	354	242	0.999
	6	5.039	2.986	94.89	0.49	348	92	0.992
	7	+5.010	+4.309	107.08	+0.52	344	83	0.962
	8	4.701	5.383	119.28	0.55	340	77	0.913
	9	4.119	6.173	131.48	0.57	338	73	0.848
	10	3.293	6.661	143.68	0.59	337	70	0.771
	11	2.263	6.844	155.89	0.61	336	69	0.685
	12	+1.086	6.727	168.11	0.62	337	68	0.594
	13	-0.174	+6.324	180.33	+0.63	339	68	0.499
	14	1.444	5.652	192.55	0.64	341	69	0.405
	15	2.647	4.732	204.78	0.65	344	72	0.313
	16	3.709	3.593	217.02	0.66	348	75	0.226
	17	4.558	2.270	229.26	0.67	353	80	0.149
	18	5.135	+0.812	241.51	0.69	358	86	0.084
	19	-5.393	-0.720	253.76	+0.70	4	94	0.035
	20	5.308	2.248	266.01	0.72	9	109	0.007
	21	4.883	3.682	278.26	0.74	15	244	0.002
	22	4.149	4.925	290.51	0.76	19	275	0.022
	23	3.164	5.885	302.76	0.79	22	283	0.067
	24	2.011	6.487	315.01	0.81	23	288	0.136
	25	-0.779	-6.682	327.25	+0.84	23	290	0.225
	26	+0.443	6.455	339.48	0.87	22	291	0.329
	27	1.583	5.826	351.71	0.91	20	290	0.441
	28	2.587	4.841	3.93	0.94	17	288	0.556
	29	3.426	3.573	16.15	0.97	12	285	0.667
	30	4.083	2.105	28.35	1.01	7	280	0.768
	31	+4.557	-0.532	40.55	+1.04	1	273	0.854
Aug.	1	4.845	+1.051	52.75	1.08	356	266	0.922
	2	4.947	2.555	64.94	1.11	350	256	0.969
	3	4.856	3.901	77.13	1.14	345	236	0.995
	4	4.566	5.025	89.32	1.17	341	116	0.998
	5	4.069	5.882	101.51	1.19	339	85	0.980
	6	+3.365	+6.445	113.70	+1.21	337	77	0.944
	7	2.463	6.703	125.90	1.22	336	73	0.891
	8	1.388	6.659	138.09	1.23	337	71	0.824
	9	+0.177	6.326	150.30	1.24	338	70	0.746
	10	-1.115	5.725	162.50	1.25	340	71	0.660
	11	2.420	4.880	174.71	1.25	343	73	0.568
	12	-3.660	+3.820	186.93	+1.25	347	75	0.472
	13	4.750	2.578	199.15	1.25	351	79	0.376
	14	5.603	+1.195	211.38	1.25	356	84	0.283
	15	6.136	-0.278	223.61	1.26	2	90	0.196
	16	-6.282	-1.775	235.85	+1.26	7	97	0.119

MOON, 2020
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date 0^h TT		The Earth's Selenographic Long.	The Earth's Selenographic Lat.	The Sun's Selenographic Colong.	The Sun's Selenographic Lat.	Position Angle of Axis	Position Angle of Bright Limb	Fraction Illuminated
		°	°	°	°	°	°	
Aug.	16	-6.282	-1.775	235.85	+1.26	7	97	0.119
	17	5.998	3.217	248.09	1.27	13	106	0.058
	18	5.276	4.510	260.33	1.27	17	119	0.018
	19	4.158	5.553	272.58	1.28	21	180	0.002
	20	2.728	6.256	284.82	1.30	23	271	0.013
	21	-1.116	6.549	297.07	1.31	24	283	0.052
	22	+0.535	-6.404	309.30	+1.33	23	287	0.117
	23	2.084	5.834	321.54	1.34	21	288	0.204
	24	3.423	4.891	333.77	1.36	17	287	0.306
	25	4.483	3.655	345.99	1.39	13	284	0.417
	26	5.240	2.220	358.20	1.41	8	280	0.529
	27	5.702	-0.682	10.41	1.43	3	274	0.639
	28	+5.896	+0.867	22.61	+1.46	357	268	0.739
	29	5.857	2.343	34.80	1.48	351	261	0.826
	30	5.618	3.674	46.99	1.51	346	254	0.897
	31	5.203	4.801	59.17	1.53	342	246	0.950
Sept.	1	4.626	5.678	71.35	1.54	339	233	0.984
	2	3.894	6.274	83.53	1.56	337	186	0.998
	3	+3.010	+6.572	95.71	+1.57	337	96	0.992
	4	1.980	6.571	107.89	1.57	337	80	0.969
	5	+0.817	6.281	120.08	1.58	338	75	0.928
	6	-0.453	5.721	132.26	1.57	340	74	0.872
	7	1.791	4.919	144.45	1.57	342	74	0.803
	8	3.139	3.906	156.64	1.56	346	76	0.723
	9	-4.426	+2.719	168.83	+1.55	350	79	0.635
	10	5.568	+1.397	181.03	1.54	354	83	0.540
	11	6.474	-0.013	193.24	1.53	360	88	0.441
	12	7.050	1.456	205.45	1.52	5	94	0.342
	13	7.210	2.867	217.67	1.51	10	100	0.246
	14	6.892	4.165	229.89	1.50	15	107	0.159
	15	-6.066	-5.258	242.12	+1.49	19	114	0.086
	16	4.760	6.051	254.35	1.49	22	124	0.033
	17	3.060	6.458	266.58	1.48	23	151	0.005
	18	-1.114	6.423	278.81	1.48	23	261	0.006
	19	+0.898	5.935	291.04	1.48	22	281	0.038
	20	2.793	5.034	303.27	1.49	19	284	0.096
	21	+4.420	-3.802	315.49	+1.49	15	283	0.178
	22	5.683	2.346	327.71	1.50	10	280	0.276
	23	6.543	-0.780	339.92	1.50	4	276	0.383
	24	7.006	+0.793	352.12	1.51	358	270	0.493
	25	7.112	2.284	4.32	1.52	353	264	0.599
	26	6.913	3.622	16.50	1.53	347	258	0.699
	27	+6.465	+4.754	28.69	+1.54	343	252	0.788
	28	5.816	5.637	40.86	1.55	340	246	0.863
	29	5.005	6.244	53.04	1.56	338	241	0.923
	30	4.058	6.560	65.20	1.56	337	234	0.966
Oct.	1	+2.996	+6.579	77.37	+1.56	337	219	0.991

MOON, 2020
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date 0^h TT		The Earth's Selenographic Long.	The Earth's Selenographic Lat.	The Sun's Selenographic Colong.	The Sun's Selenographic Lat.	Position Angle of Axis	Position Angle of Bright Limb	Fraction Illuminated
		°	°	°	°	°	°	
Oct.	1	+2.996	+6.579	77.37	+1.56	337	219	0.991
	2	1.830	6.308	89.54	1.55	337	141	0.998
	3	+0.577	5.765	101.70	1.55	339	88	0.987
	4	-0.743	4.976	113.87	1.53	342	79	0.959
	5	2.101	3.975	126.03	1.52	345	78	0.915
	6	3.453	2.800	138.20	1.50	349	79	0.855
	7	-4.741	+1.496	150.38	+1.48	353	82	0.782
	8	5.894	+0.111	162.55	1.46	358	87	0.698
	9	6.830	-1.304	174.73	1.43	3	92	0.604
	10	7.460	2.688	186.92	1.41	9	97	0.504
	11	7.697	3.975	199.11	1.38	14	103	0.400
	12	7.468	5.088	211.31	1.36	18	109	0.298
	13	-6.729	-5.943	223.52	+1.34	21	114	0.201
	14	5.481	6.455	235.73	1.32	23	119	0.117
	15	3.789	6.552	247.94	1.30	23	124	0.052
	16	-1.778	6.195	260.15	1.28	22	135	0.012
	17	+0.374	5.391	272.37	1.26	20	234	0.002
	18	2.471	4.198	284.59	1.25	16	277	0.023
	19	+4.338	-2.722	296.80	+1.24	12	280	0.072
	20	5.842	-1.091	309.01	1.23	6	277	0.145
	21	6.913	+0.569	321.21	1.22	0	272	0.236
	22	7.534	2.148	333.41	1.21	354	266	0.337
	23	7.728	3.563	345.60	1.21	349	260	0.443
	24	7.545	4.752	357.78	1.20	344	255	0.547
	25	+7.046	+5.679	9.96	+1.20	341	250	0.646
	26	6.295	6.319	22.13	1.19	338	246	0.738
	27	5.350	6.661	34.29	1.19	337	243	0.818
	28	4.258	6.704	46.45	1.18	337	240	0.885
	29	3.062	6.455	58.61	1.17	337	238	0.938
	30	1.794	5.929	70.76	1.15	339	234	0.975
	31	+0.481	+5.150	82.91	+1.14	341	220	0.995
Nov.	1	-0.851	4.149	95.06	1.11	344	110	0.998
	2	2.173	2.968	107.21	1.09	348	84	0.983
	3	3.450	1.651	119.35	1.06	352	83	0.950
	4	4.642	+0.251	131.51	1.03	357	85	0.900
	5	5.696	-1.177	143.66	1.00	2	90	0.834
	6	-6.551	-2.572	155.82	+0.97	7	95	0.755
	7	7.141	3.871	167.98	0.93	12	100	0.663
	8	7.396	5.005	180.15	0.90	17	105	0.562
	9	7.255	5.903	192.32	0.86	20	110	0.455
	10	6.676	6.494	204.50	0.83	22	114	0.347
	11	5.648	6.711	216.69	0.80	23	117	0.243
	12	-4.204	-6.505	228.88	+0.77	23	118	0.150
	13	2.429	5.856	241.08	0.74	21	119	0.075
	14	-0.456	4.788	253.28	0.71	18	121	0.023
	15	+1.555	3.375	265.48	0.68	14	146	0.001
	16	+3.438	-1.731	277.68	+0.65	9	273	0.009

MOON, 2020
EPHEMERIS FOR PHYSICAL OBSERVATIONS
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		°	°	°	°	°	°	
Nov.	16	+3.438	-1.731	277.68	+0.65	9	273	0.009
	17	5.049	+0.008	289.88	0.63	3	274	0.047
	18	6.287	1.708	302.08	0.61	357	270	0.108
	19	7.096	3.258	314.27	0.59	351	264	0.189
	20	7.465	4.577	326.46	0.57	346	258	0.281
	21	7.416	5.612	338.64	0.55	342	254	0.381
	22	+6.997	+6.339	350.81	+0.54	339	250	0.482
	23	6.268	6.750	2.98	0.53	337	247	0.580
	24	5.295	6.848	15.14	0.51	337	245	0.674
	25	4.145	6.646	27.29	0.49	337	244	0.760
	26	2.879	6.161	39.44	0.48	338	243	0.835
	27	1.553	5.416	51.59	0.46	340	244	0.899
	28	+0.218	+4.441	63.73	+0.43	343	245	0.948
	29	-1.084	3.271	75.87	0.41	347	246	0.982
	30	2.315	1.951	88.00	0.38	351	241	0.998
Dec.	1	3.440	+0.532	100.14	0.35	356	87	0.997
	2	4.427	-0.925	112.27	0.32	1	87	0.976
	3	5.243	2.358	124.41	0.28	6	91	0.936
	4	-5.856	-3.697	136.55	+0.24	11	97	0.878
	5	6.231	4.873	148.69	0.21	16	102	0.803
	6	6.336	5.820	160.84	0.17	19	106	0.714
	7	6.144	6.473	172.99	0.13	22	110	0.613
	8	5.634	6.776	185.15	0.09	23	113	0.504
	9	4.806	6.689	197.32	0.06	23	115	0.392
	10	-3.679	-6.188	209.49	+0.02	22	115	0.284
	11	2.299	5.283	221.67	-0.02	20	114	0.184
	12	-0.743	4.017	233.85	0.05	16	111	0.101
	13	+0.891	2.471	246.04	0.08	11	107	0.040
	14	2.490	-0.758	258.23	0.12	6	101	0.007
	15	3.936	+0.992	270.42	0.15	359	280	0.002
	16	+5.129	+2.650	282.61	-0.17	353	271	0.024
	17	5.987	4.109	294.80	0.20	348	264	0.071
	18	6.463	5.292	306.99	0.22	343	258	0.138
	19	6.541	6.154	319.17	0.25	340	254	0.220
	20	6.237	6.681	331.35	0.27	338	250	0.310
	21	5.591	6.874	343.52	0.28	337	248	0.406
	22	+4.659	+6.751	355.68	-0.30	337	246	0.503
	23	3.514	6.335	7.84	0.32	338	246	0.597
	24	2.229	5.652	19.99	0.34	340	247	0.688
	25	+0.881	4.733	32.13	0.36	342	249	0.771
	26	-0.458	3.612	44.27	0.38	345	251	0.845
	27	1.719	2.329	56.41	0.40	349	255	0.908
	28	-2.845	+0.929	68.54	-0.43	354	261	0.956
	29	3.788	-0.531	80.67	0.46	359	269	0.987
	30	4.513	1.987	92.80	0.48	5	316	1.000
	31	4.998	3.369	104.93	0.51	10	84	0.992
	32	-5.232	-4.600	117.06	-0.55	15	95	0.963

MERCURY, 2020
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude ° ' "	Heliocentric Latitude ° ' "	Radius Vector	Date		Heliocentric Longitude ° ' "	Heliocentric Latitude ° ' "	Radius Vector
Jan.	0	259 42 17.2	-3 38 07.9	0.466 6212	Feb.	15	95 09 08.5	+5 06 01.5	0.309 9640
	1	262 27 14.9	3 55 09.0	0.466 2660		16	101 22 01.5	5 35 23.6	0.312 0174
	2	265 12 40.2	4 11 39.7	0.465 6319		17	107 29 55.5	6 00 29.6	0.314 6420
	3	267 58 45.5	4 27 38.8	0.464 7197		18	113 31 37.7	6 21 08.8	0.317 7990
	4	270 45 43.1	4 43 04.5	0.463 5304		19	119 26 05.3	6 37 18.5	0.321 4436
	5	273 33 45.6	4 57 55.3	0.462 0654		20	125 12 27.0	6 49 03.0	0.325 5271
	6	276 23 05.7	-5 12 09.3	0.460 3265		21	130 50 02.8	+6 56 32.0	0.329 9982
	7	279 13 56.5	5 25 44.6	0.458 3157		22	136 18 24.4	6 59 59.8	0.334 8047
	8	282 06 31.3	5 38 38.8	0.456 0358		23	141 37 13.9	6 59 43.9	0.339 8946
	9	285 01 03.9	5 50 49.5	0.453 4898		24	146 46 23.4	6 56 03.8	0.345 2169
	10	287 57 48.3	6 02 14.1	0.450 6812		25	151 45 53.1	6 49 19.9	0.350 7230
	11	290 56 59.3	6 12 49.4	0.447 6142		26	156 35 50.4	6 39 52.7	0.356 3665
	12	293 58 51.8	-6 22 32.2	0.444 2935		27	161 16 28.4	+6 28 02.3	0.362 1041
	13	297 03 41.6	6 31 18.9	0.440 7247		28	165 48 04.5	6 14 07.6	0.367 8958
	14	300 11 44.9	6 39 05.5	0.436 9140		29	170 10 59.7	5 58 26.4	0.373 7045
	15	303 23 18.7	6 45 47.5	0.432 8686	Mar.	1	174 25 37.1	5 41 14.9	0.379 4967
	16	306 38 40.5	6 51 20.3	0.428 5966		2	178 32 21.6	5 22 47.7	0.385 2415
	17	309 58 08.6	6 55 38.5	0.424 1071		3	182 31 38.6	5 03 18.1	0.390 9115
	18	313 22 02.0	-6 58 36.4	0.419 4107		4	186 23 54.2	+4 42 57.7	0.396 4817
	19	316 50 40.4	7 00 08.0	0.414 5191		5	190 09 34.3	4 21 56.9	0.401 9298
	20	320 24 24.2	7 00 06.4	0.409 4458		6	193 49 04.2	4 00 24.5	0.407 2359
	21	324 03 34.5	6 58 24.7	0.404 2057		7	197 22 48.9	3 38 28.5	0.412 3821
	22	327 48 33.0	6 54 55.2	0.398 8157		8	200 51 12.4	3 16 15.8	0.417 3528
	23	331 39 41.6	6 49 30.0	0.393 2949		9	204 14 38.0	2 53 52.1	0.422 1338
	24	335 37 23.0	-6 42 00.7	0.387 6645		10	207 33 27.8	+2 31 22.7	0.426 7126
	25	339 41 59.5	6 32 18.8	0.381 9483		11	210 48 03.4	2 08 51.8	0.431 0784
	26	343 53 53.6	6 20 15.7	0.376 1727		12	213 58 45.1	1 46 23.4	0.435 2213
	27	348 13 27.2	6 05 42.8	0.370 3672		13	217 05 52.4	1 24 00.5	0.439 1328
	28	352 41 01.1	5 48 32.3	0.364 5639		14	220 09 43.8	1 01 46.1	0.442 8053
	29	357 16 54.7	5 28 36.9	0.358 7986		15	223 10 37.2	0 39 42.5	0.446 2322
	30	2 01 25.4	-5 05 50.5	0.353 1099		16	226 08 49.6	+0 17 52.0	0.449 4077
	31	6 54 47.4	4 40 09.1	0.347 5399		17	229 04 37.2	-0 03 43.7	0.452 3267
Feb.	1	11 57 11.1	4 11 30.7	0.342 1336		18	231 58 15.6	0 25 03.0	0.454 9849
	2	17 08 42.2	3 39 56.7	0.336 9387		19	234 49 59.9	0 46 04.4	0.457 3784
	3	22 29 20.4	3 05 32.1	0.332 0054		20	237 40 04.5	1 06 46.6	0.459 5040
	4	27 58 58.5	2 28 26.7	0.327 3851		21	240 28 43.4	1 27 08.5	0.461 3588
	5	33 37 20.8	-1 48 55.3	0.323 1304		22	243 16 10.1	-1 47 08.8	0.462 9406
	6	39 24 02.8	1 07 18.3	0.319 2929		23	246 02 38.0	2 06 46.5	0.464 2473
	7	45 18 29.9	-0 24 02.1	0.315 9227		24	248 48 19.8	2 26 00.7	0.465 2775
	8	51 19 56.6	+0 20 21.5	0.313 0664		25	251 33 28.2	2 44 50.2	0.466 0300
	9	57 27 27.1	1 05 15.3	0.310 7656		26	254 18 15.7	3 03 14.1	0.466 5038
	10	63 39 55.3	1 49 58.4	0.309 0554		27	257 02 54.7	3 21 11.2	0.466 6985
	11	69 56 05.8	+2 33 47.4	0.307 9626		28	259 47 37.2	-3 38 40.4	0.466 6139
	12	76 14 35.7	3 15 58.4	0.307 5048		29	262 32 35.6	3 55 40.5	0.466 2500
	13	82 33 56.6	3 55 49.3	0.307 6895		30	265 18 02.1	4 12 10.3	0.465 6072
	14	88 52 37.8	4 32 41.3	0.308 5137		31	268 04 08.8	4 28 08.3	0.464 6863
	15	95 09 08.5	+5 06 01.5	0.309 9640	Apr.	1	270 51 08.3	-4 43 32.9	0.463 4884

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Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector	Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector
	° ' "	° ' "			° ' "	° ' "	
Apr. 1	270 51 08.3	-4 43 32.9	0.463 4884	May 17	119 37 10.5	+6 37 44.4	0.321 5657
2	273 39 13.0	4 58 22.6	0.462 0148	18	125 23 16.2	6 49 20.8	0.325 6620
3	276 28 35.8	5 12 35.5	0.460 2673	19	131 00 35.0	6 56 42.0	0.330 1442
4	279 19 29.7	5 26 09.5	0.458 2481	20	136 28 38.8	7 00 02.6	0.334 9602
5	282 12 08.0	5 39 02.3	0.455 9599	21	141 47 10.3	6 59 40.0	0.340 0579
6	285 06 44.5	5 51 11.7	0.453 4056	22	146 56 01.7	6 55 53.9	0.345 3866
7	288 03 33.3	-6 02 34.7	0.450 5888	23	151 55 13.3	+6 49 04.6	0.350 8975
8	291 02 49.1	6 13 08.5	0.447 5139	24	156 44 53.0	6 39 32.7	0.356 5444
9	294 04 46.9	6 22 49.6	0.444 1854	25	161 25 13.8	6 27 38.1	0.362 2842
10	297 09 42.5	6 31 34.5	0.440 6090	26	165 56 33.4	6 13 39.9	0.368 0768
11	300 17 52.2	6 39 19.1	0.436 7909	27	170 19 12.7	5 57 55.6	0.373 8854
12	303 29 32.8	6 45 59.0	0.432 7383	28	174 33 35.0	5 40 41.5	0.379 6763
13	306 45 02.0	-6 51 29.5	0.428 4593	29	178 40 05.1	+5 22 12.2	0.385 4191
14	310 04 38.2	6 55 45.3	0.423 9632	30	182 39 08.7	5 02 40.9	0.391 0863
15	313 28 40.2	6 58 40.6	0.419 2606	31	186 31 11.7	4 42 19.1	0.396 6529
16	316 57 27.9	7 00 09.3	0.414 3632	June 1	190 16 39.9	4 21 17.1	0.402 0967
17	320 31 21.6	7 00 04.8	0.409 2844	2	193 55 58.7	3 59 43.9	0.407 3980
18	324 10 42.6	6 58 19.8	0.404 0394	3	197 29 33.1	3 37 47.3	0.412 5389
19	327 55 52.2	-6 54 46.8	0.398 6451	4	200 57 47.1	+3 15 34.1	0.417 5037
20	331 47 12.8	6 49 17.9	0.393 1206	5	204 21 03.8	2 53 10.2	0.422 2785
21	335 45 06.8	6 41 44.5	0.387 4873	6	207 39 45.5	2 30 40.7	0.426 8508
22	339 49 56.6	6 31 58.3	0.381 7689	7	210 54 13.6	2 08 09.8	0.431 2097
23	344 02 04.8	6 19 50.6	0.375 9920	8	214 04 48.4	1 45 41.4	0.435 3454
24	348 21 53.0	6 05 13.0	0.370 1861	9	217 11 49.4	1 23 18.8	0.439 2495
25	352 49 42.2	-5 47 57.4	0.364 3836	10	220 15 35.1	+1 01 04.7	0.442 9144
26	357 25 51.8	5 27 56.7	0.358 6202	11	223 16 23.3	0 39 01.5	0.446 3335
27	2 10 38.8	5 05 04.9	0.352 9347	12	226 14 31.0	+0 17 11.4	0.449 5010
28	7 04 17.5	4 39 17.9	0.347 3692	13	229 10 14.4	-0 04 23.9	0.452 4120
29	12 06 58.2	4 10 34.0	0.341 9688	14	232 03 49.2	0 25 42.6	0.455 0620
30	17 18 46.3	3 38 54.6	0.336 7815	15	234 55 30.2	0 46 43.5	0.457 4472
May 1	22 39 41.5	-3 04 24.9	0.331 8572	16	237 45 32.0	-1 07 25.1	0.459 5643
2	28 09 36.0	2 27 14.7	0.327 2477	17	240 34 08.6	1 27 46.3	0.461 4107
3	33 48 14.3	1 47 39.0	0.323 0053	18	243 21 33.4	1 47 45.9	0.462 9839
4	39 35 11.2	1 05 58.5	0.319 1818	19	246 07 59.7	2 07 22.9	0.464 2821
5	45 29 51.9	-0 22 39.6	0.315 8270	20	248 53 40.4	2 26 36.3	0.465 3036
6	51 31 30.7	+0 21 45.4	0.312 9876	21	251 38 48.1	2 45 25.1	0.466 0475
7	57 39 11.4	+1 06 39.5	0.310 7048	22	254 23 35.3	-3 03 48.1	0.466 5127
8	63 51 47.5	1 51 21.5	0.309 0135	23	257 08 14.2	3 21 44.4	0.466 6987
9	70 08 03.4	2 35 08.1	0.307 9403	24	259 52 57.2	3 39 12.7	0.466 6055
10	76 26 36.0	3 17 15.4	0.307 5024	25	262 37 56.4	3 56 11.9	0.466 2330
11	82 45 56.9	3 57 01.2	0.307 7072	26	265 23 24.0	4 12 40.7	0.465 5816
12	89 04 35.1	4 33 47.0	0.308 5511	27	268 09 32.3	4 28 37.7	0.464 6522
13	95 21 00.2	+5 07 00.1	0.310 0206	28	270 56 33.7	-4 44 01.3	0.463 4458
14	101 33 44.8	5 36 14.5	0.312 0922	29	273 44 40.7	4 58 49.9	0.461 9638
15	107 41 28.1	6 01 12.2	0.314 7340	30	276 34 06.2	5 13 01.5	0.460 2080
16	113 42 57.4	6 21 43.0	0.317 9068	July 1	279 25 03.2	5 26 34.2	0.458 1806
17	119 37 10.5	+6 37 44.4	0.321 5657	2	282 17 45.0	-5 39 25.8	0.455 8842

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Date	Heliocentric Longitude			Heliocentric Latitude			Radius Vector	Date	Heliocentric Longitude			Heliocentric Latitude			Radius Vector
	°	'	"	°	'	"			°	'	"	°	'	"	
July 1	279	25	03.2	-5	26	34.2	0.458 1806	Aug. 16	136	38	35.1	+7	00	04.9	0.335 1129
2	282	17	45.0	5	39	25.8	0.455 8842	17	141	56	49.0	6	59	35.9	0.340 2178
3	285	12	25.5	5	51	33.7	0.453 3219	18	147	05	22.6	6	55	43.9	0.345 5522
4	288	09	18.8	6	02	55.3	0.450 4973	19	152	04	16.9	6	48	49.4	0.351 0673
5	291	08	39.4	6	13	27.4	0.447 4146	20	156	53	39.4	6	39	12.9	0.356 7172
6	294	10	42.6	6	23	06.8	0.444 0786	21	161	33	43.6	6	27	14.3	0.362 4587
7	297	15	44.0	-6	31	49.9	0.440 4948	22	166	04	47.2	+6	13	12.6	0.368 2519
8	300	23	60.0	6	39	32.5	0.436 6696	23	170	27	11.3	5	57	25.3	0.374 0600
9	303	35	47.4	6	46	10.3	0.432 6102	24	174	41	19.2	5	40	08.8	0.379 8496
10	306	51	24.0	6	51	38.6	0.428 3247	25	178	47	35.6	5	21	37.4	0.385 5902
11	310	11	08.1	6	55	51.9	0.423 8224	26	182	46	26.3	5	02	04.3	0.391 2543
12	313	35	18.7	6	58	44.6	0.419 1139	27	186	38	17.1	4	41	41.1	0.396 8172
13	317	04	15.4	-7	00	10.5	0.414 2111	28	190	23	34.0	+4	20	38.0	0.402 2567
14	320	38	18.9	7	00	02.9	0.409 1274	29	194	02	42.3	3	59	04.0	0.407 5532
15	324	17	50.1	6	58	14.6	0.403 8779	30	197	36	06.9	3	37	06.8	0.412 6888
16	328	03	10.8	6	54	38.1	0.398 4797	31	201	04	11.8	3	14	53.2	0.417 6479
17	331	54	43.0	6	49	05.4	0.392 9520	Sept. 1	204	27	20.1	2	52	29.0	0.422 4166
18	335	52	49.3	6	41	28.0	0.387 3160	2	207	45	54.1	2	29	59.3	0.426 9824
19	339	57	52.1	-6	31	37.6	0.381 5959	3	211	00	15.1	+2	07	28.4	0.431 3346
20	344	10	13.8	6	19	25.3	0.375 8181	4	214	10	43.4	1	45	00.2	0.435 4633
21	348	30	16.2	6	04	42.9	0.370 0123	5	217	17	38.4	1	22	37.7	0.439 3602
22	352	58	20.2	5	47	22.3	0.364 2109	6	220	21	18.7	1	00	23.9	0.443 0177
23	357	34	44.9	5	27	16.4	0.358 4496	7	223	22	02.1	0	38	21.1	0.446 4293
24	2	19	47.6	5	04	19.3	0.352 7676	8	226	20	05.4	+0	16	31.3	0.449 5891
25	7	13	42.3	-4	38	26.9	0.347 2069	9	229	15	44.9	-0	05	03.5	0.452 4923
26	12	16	39.1	4	09	37.6	0.341 8128	10	232	09	16.2	0	26	21.7	0.455 1343
27	17	28	43.4	3	37	52.9	0.336 6330	11	235	00	54.2	0	47	22.0	0.457 5115
28	22	49	54.5	3	03	18.1	0.331 7180	12	237	50	53.5	1	08	03.0	0.459 6205
29	28	20	04.7	2	26	03.3	0.327 1192	13	240	39	27.8	1	28	23.6	0.461 4587
30	33	58	57.8	1	46	23.5	0.322 8890	14	243	26	50.9	1	48	22.5	0.463 0237
31	39	46	08.7	-1	04	39.7	0.319 0793	15	246	13	15.8	-2	07	58.9	0.464 3136
Aug. 1	45	41	02.0	-0	21	18.4	0.315 7397	16	248	58	55.5	2	27	11.6	0.465 3269
2	51	42	51.8	+0	23	08.0	0.312 9167	17	251	44	02.5	2	45	59.6	0.466 0624
3	57	50	41.6	1	08	02.2	0.310 6514	18	254	28	49.4	3	04	21.8	0.466 5192
4	64	03	24.6	1	52	43.0	0.308 9785	19	257	13	28.5	3	22	17.3	0.466 6969
5	70	19	45.1	2	36	27.1	0.307 9243	20	259	58	11.9	3	39	44.7	0.466 5953
6	76	38	19.6	+3	18	30.5	0.307 5057	21	262	43	11.9	-3	56	43.0	0.466 2145
7	82	57	39.7	3	58	11.3	0.307 7297	22	265	28	40.7	4	13	10.8	0.465 5548
8	89	16	14.4	4	34	51.0	0.308 5926	23	268	14	50.5	4	29	06.8	0.464 6171
9	95	32	33.2	5	07	57.1	0.310 0803	24	271	01	53.9	4	44	29.3	0.463 4025
10	101	45	09.2	5	37	03.9	0.312 1693	25	273	50	03.2	4	59	16.8	0.461 9123
11	107	52	41.6	6	01	53.5	0.314 8274	26	276	39	31.4	5	13	27.3	0.460 1483
12	113	53	58.1	+6	22	16.1	0.318 0151	27	279	30	31.5	-5	26	58.8	0.458 1128
13	119	47	56.6	6	38	09.3	0.321 6875	28	282	23	16.8	5	39	49.0	0.455 8085
14	125	33	46.5	6	49	37.7	0.325 7956	29	285	18	01.2	5	51	55.6	0.453 2383
15	131	10	48.6	6	56	51.4	0.330 2882	30	288	14	58.7	6	03	15.6	0.450 4059
16	136	38	35.1	+7	00	04.9	0.335 1129	Oct. 1	291	14	24.1	-6	13	46.2	0.447 3155

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		°	'	"	°	'	"				°	'	"	°	'	"	
Oct.	1	291	14	24.1	-6	13	46.2	0.447 3155	Nov.	16	157	02	33.7	+6	38	52.9	0.356 8910
	2	294	16	32.6	6	23	23.9	0.443 9721		17	161	42	21.2	6	26	50.2	0.362 6347
	3	297	21	39.7	6	32	05.1	0.440 3810		18	166	13	08.7	6	12	45.0	0.368 4288
	4	300	30	01.9	6	39	45.8	0.436 5487		19	170	35	17.3	5	56	54.8	0.374 2369
	5	303	41	56.1	6	46	21.6	0.432 4823		20	174	49	10.4	5	39	35.7	0.380 0254
	6	306	57	40.0	6	51	47.6	0.428 1902		21	178	55	12.9	5	21	02.2	0.385 7641
	7	310	17	31.9	-6	55	58.5	0.423 6816		22	182	53	50.4	+5	01	27.4	0.391 4255
	8	313	41	50.9	6	58	48.6	0.418 9671		23	186	45	28.8	4	41	02.8	0.396 9850
	9	317	10	56.7	7	00	11.7	0.414 0586		24	190	30	34.1	4	19	58.7	0.402 4205
	10	320	45	09.9	7	00	01.1	0.408 9696		25	194	09	31.5	3	58	23.8	0.407 7123
	11	324	24	51.4	6	58	09.6	0.403 7154		26	197	42	46.0	3	36	26.0	0.412 8428
	12	328	10	23.0	6	54	29.7	0.398 3130		27	201	10	41.4	3	14	11.9	0.417 7963
	13	332	02	06.9	-6	48	53.3	0.392 7817		28	204	33	41.1	+2	51	47.5	0.422 5590
	14	336	00	25.5	6	41	11.9	0.387 1429		29	207	52	07.0	2	29	17.7	0.427 1186
	15	340	05	41.3	6	31	17.2	0.381 4206		30	211	06	20.6	2	06	46.9	0.431 4641
	16	344	18	16.7	6	19	00.5	0.375 6415	Dec.	1	214	16	42.0	1	44	18.7	0.435 5859
	17	348	38	33.5	6	04	13.4	0.369 8353		2	217	23	30.8	1	21	56.5	0.439 4756
	18	353	06	52.5	5	46	47.8	0.364 0346		3	220	27	05.5	0	59	42.9	0.443 1257
	19	357	43	32.8	-5	26	36.7	0.358 2752		4	223	27	43.7	+0	37	40.5	0.446 5297
	20	2	28	51.4	5	03	34.3	0.352 5963		5	226	25	42.3	+0	15	51.2	0.449 6818
	21	7	23	02.5	4	37	36.5	0.347 0400		6	229	21	17.7	-0	05	43.1	0.452 5771
	22	12	26	15.9	4	08	41.7	0.341 6516		7	232	14	45.3	0	27	00.9	0.455 2111
	23	17	38	36.9	3	36	51.7	0.336 4792		8	235	06	20.1	0	48	00.6	0.457 5801
	24	23	00	04.6	3	02	11.9	0.331 5730		9	237	56	16.4	1	08	41.0	0.459 6809
	25	28	30	30.9	-2	24	52.3	0.326 9847		10	240	44	48.4	-1	29	00.9	0.461 5108
	26	34	09	39.6	1	45	08.5	0.322 7666		11	243	32	09.5	1	48	59.2	0.463 0674
	27	39	57	05.1	1	03	21.2	0.318 9705		12	246	18	32.8	2	08	34.8	0.464 3489
	28	45	52	11.8	-0	19	57.5	0.315 6460		13	249	04	11.2	2	27	46.8	0.465 3537
	29	51	54	13.5	+0	24	30.3	0.312 8394		14	251	49	17.5	2	46	34.0	0.466 0806
	30	58	02	13.2	1	09	24.7	0.310 5917		15	254	34	03.9	3	04	55.4	0.466 5290
	31	64	15	04.0	+1	54	04.5	0.308 9373		16	257	18	42.9	-3	22	50.0	0.466 6981
Nov.	1	70	31	29.8	2	37	46.1	0.307 9022		17	260	03	26.6	3	40	16.6	0.466 5879
	2	76	50	07.0	3	19	45.8	0.307 5032		18	262	48	27.3	3	57	13.9	0.466 1985
	3	83	09	27.1	3	59	21.5	0.307 7468		19	265	33	57.2	4	13	40.8	0.465 5303
	4	89	27	59.0	4	35	55.2	0.308 6289		20	268	20	08.4	4	29	35.8	0.464 5841
	5	95	44	12.3	5	08	54.3	0.310 1354		21	271	07	13.6	4	44	57.3	0.463 3609
	6	101	56	40.2	+5	37	53.4	0.312 2422		22	273	55	25.1	-4	59	43.6	0.461 8622
	7	108	04	02.1	6	02	35.0	0.314 9170		23	276	44	55.9	5	13	52.9	0.460 0899
	8	114	05	06.1	6	22	49.3	0.318 1201		24	279	35	59.0	5	27	23.2	0.458 0461
	9	119	58	50.4	6	38	34.3	0.321 8065		25	282	28	47.7	5	40	12.1	0.455 7334
	10	125	44	24.7	6	49	54.7	0.325 9271		26	285	23	36.0	5	52	17.3	0.453 1551
	11	131	21	10.2	6	57	00.8	0.330 4305		27	288	20	37.9	6	03	35.8	0.450 3146
	12	136	48	39.6	+7	00	07.3	0.335 2646		28	291	20	08.0	-6	14	04.8	0.447 2164
	13	142	06	35.8	6	59	31.7	0.340 3772		29	294	22	21.7	6	23	40.9	0.443 8651
	14	147	14	51.7	6	55	33.8	0.345 7178		30	297	27	34.6	6	32	20.3	0.440 2665
	15	152	13	28.4	6	48	34.0	0.351 2377		31	300	36	03.0	6	39	59.0	0.436 4268
	16	157	02	33.7	+6	38	52.9	0.356 8910		32	303	48	04.0	-6	46	32.7	0.432 3533

MERCURY, 2020
GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Appare Geocent Latituc	
		°	'	"	°	'	"			°	'	"	°	'
Jan.	0	272	48	34.9	-1	11	01.4	Feb.	15	342	31	47.4	+1	54
	1	274	22	55.4	1	16	22.0		16	342	47	45.1	2	10
	2	275	57	34.1	1	21	29.9		17	342	53	22.5	2	25
	3	277	32	31.6	1	26	24.7		18	342	48	33.3	2	40
	4	279	07	49.0	1	31	05.6		19	342	33	24.4	2	54
	5	280	43	27.1	1	35	32.1		20	342	08	17.7	3	06
	6	282	19	26.9	-1	39	43.7		21	341	33	50.0	+3	17
	7	283	55	49.3	1	43	39.5		22	340	50	54.2	3	26
	8	285	32	35.1	1	47	19.1		23	340	00	37.7	3	34
	9	287	09	45.3	1	50	41.6		24	339	04	20.8	3	39
	10	288	47	20.6	1	53	46.3		25	338	03	33.8	3	42
	11	290	25	21.7	1	56	32.5		26	336	59	53.0	3	43
	12	292	03	49.4	-1	58	59.3		27	335	54	56.7	+3	41
	13	293	42	44.2	2	01	05.9		28	334	50	20.8	3	38
	14	295	22	06.4	2	02	51.5		29	333	47	34.8	3	32
	15	297	01	56.3	2	04	15.0	Mar.	1	332	47	58.5	3	25
	16	298	42	14.1	2	05	15.6		2	331	52	39.9	3	15
	17	300	22	59.4	2	05	52.0		3	331	02	33.9	3	05
	18	302	04	11.9	-2	06	03.4		4	330	18	22.3	+2	53
	19	303	45	50.6	2	05	48.4		5	329	40	34.2	2	41
	20	305	27	54.1	2	05	05.8		6	329	09	27.5	2	27
	21	307	10	20.7	2	03	54.5		7	328	45	10.3	2	14
	22	308	53	07.8	2	02	13.0		8	328	27	42.8	2	00
	23	310	36	12.2	1	59	59.9		9	328	16	58.6	1	45
	24	312	19	29.9	-1	57	13.8		10	328	12	46.8	+1	31
	25	314	02	55.8	1	53	53.2		11	328	14	53.1	1	17
	26	315	46	23.8	1	49	56.6		12	328	23	00.7	1	03
	27	317	29	46.4	1	45	22.3		13	328	36	51.7	0	49
	28	319	12	54.5	1	40	08.9		14	328	56	07.4	0	36
	29	320	55	37.3	1	34	14.7		15	329	20	29.1	0	22
	30	322	37	42.1	-1	27	38.2		16	329	49	38.5	+0	10
	31	324	18	53.7	1	20	18.0		17	330	23	17.7	-0	02
Feb.	1	325	58	54.4	1	12	12.9		18	331	01	09.9	0	13
	2	327	37	23.8	1	03	21.6		19	331	42	59.3	0	25
	3	329	13	58.3	0	53	43.5		20	332	28	31.1	0	36
	4	330	48	11.0	0	43	17.9		21	333	17	31.3	0	46
	5	332	19	31.8	-0	32	04.9		22	334	09	47.5	-0	56
	6	333	47	26.9	0	20	05.0		23	335	05	08.0	1	06
	7	335	11	19.4	-0	07	19.3		24	336	03	22.1	1	15
	8	336	30	29.4	+0	06	10.1		25	337	04	20.2	1	23
	9	337	44	14.1	0	20	20.4		26	338	07	53.5	1	31
	10	338	51	49.4	0	35	07.5		27	339	13	54.0	1	38
	11	339	52	30.0	+0	50	26.3		28	340	22	14.5	-1	45
	12	340	45	31.1	1	06	10.4		29	341	32	48.6	1	52
	13	341	30	09.9	1	22	11.9		30	342	45	30.5	1	58
	14	342	05	46.6	1	38	21.5		31	344	00	15.0	2	03
	15	342	31	47.4	+1	54	28.5	Apr.	1	345	16	57.5	-2	08

MERCURY, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Appare Geocent Latituc	
		°	'	"	°	'	"			°	'	"	°	'
Apr.	1	345	16	57.5	-2	08	46.8	May	17	70	23	01.4	+1	47
	2	346	35	33.9	2	13	15.5		18	72	18	49.2	1	53
	3	347	56	00.7	2	17	14.3		19	74	11	59.4	1	58
	4	349	18	14.7	2	20	43.3		20	76	02	24.3	2	03
	5	350	42	13.2	2	23	42.5		21	77	49	57.9	2	07
	6	352	07	54.0	2	26	11.7		22	79	34	34.9	2	10
	7	353	35	15.2	-2	28	11.0		23	81	16	11.2	+2	13
	8	355	04	15.1	2	29	40.2		24	82	54	43.2	2	14
	9	356	34	52.8	2	30	39.4		25	84	30	08.0	2	15
	10	358	07	07.0	2	31	08.4		26	86	02	22.7	2	15
	11	359	40	57.2	2	31	07.2		27	87	31	25.2	2	14
	12	1	16	22.9	2	30	35.6		28	88	57	12.8	2	13
	13	2	53	23.6	-2	29	33.7		29	90	19	43.4	+2	10
	14	4	31	59.3	2	28	01.2		30	91	38	54.2	2	07
	15	6	12	09.9	2	25	58.2		31	92	54	42.8	2	03
	16	7	53	55.8	2	23	24.6	June	1	94	07	06.0	1	57
	17	9	37	17.2	2	20	20.4		2	95	16	00.8	1	52
	18	11	22	14.6	2	16	45.6		3	96	21	23.5	1	45
	19	13	08	48.3	-2	12	40.2		4	97	23	10.3	+1	38
	20	14	56	59.0	2	08	04.4		5	98	21	17.0	1	29
	21	16	46	47.0	2	02	58.3		6	99	15	39.1	1	20
	22	18	38	12.8	1	57	22.2		7	100	06	11.6	1	11
	23	20	31	16.5	1	51	16.4		8	100	52	49.5	1	00
	24	22	25	58.1	1	44	41.3		9	101	35	27.6	0	49
	25	24	22	17.0	-1	37	37.6		10	102	14	00.3	+0	37
	26	26	20	12.5	1	30	06.0		11	102	48	22.5	0	24
	27	28	19	43.0	1	22	07.5		12	103	18	28.8	+0	11
	28	30	20	46.3	1	13	43.3		13	103	44	14.3	-0	02
	29	32	23	19.4	1	04	54.7		14	104	05	34.6	0	17
	30	34	27	18.0	0	55	43.4		15	104	22	25.9	0	32
May	1	36	32	37.0	-0	46	11.4		16	104	34	45.5	-0	48
	2	38	39	09.7	0	36	21.1		17	104	42	31.7	1	03
	3	40	46	48.0	0	26	15.1		18	104	45	44.5	1	20
	4	42	55	22.4	0	15	56.5		19	104	44	25.8	1	36
	5	45	04	42.5	-0	05	28.8		20	104	38	39.4	1	53
	6	47	14	33.9	+0	05	05.1		21	104	28	31.9	2	09
	7	49	24	43.9	+0	15	40.2		22	104	14	12.5	-2	26
	8	51	34	56.9	0	26	12.7		23	103	55	53.7	2	42
	9	53	44	56.3	0	36	38.1		24	103	33	51.2	2	58
	10	55	54	25.0	0	46	51.9		25	103	08	24.1	3	13
	11	58	03	05.6	0	56	49.5		26	102	39	55.1	3	28
	12	60	10	40.7	1	06	26.7		27	102	08	50.3	3	41
	13	62	16	53.6	+1	15	39.0		28	101	35	39.0	-3	54
	14	64	21	28.2	1	24	22.5		29	101	00	53.4	4	06
	15	66	24	09.8	1	32	33.6		30	100	25	08.0	4	16
	16	68	24	44.8	1	40	09.0	July	1	99	48	58.7	4	25
	17	70	23	01.4	+1	47	05.8		2	99	13	02.8	-4	33

MERCURY, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Appare Geocent Latituc	
		°	'	"	°	'	"			°	'	"	°	'
July	1	99	48	58.7	-4	25	57.1	Aug.	16	141	51	45.0	+1	44
	2	99	13	02.8	4	33	36.5		17	143	53	19.5	1	45
	3	98	37	57.6	4	39	45.2		18	145	54	03.7	1	45
	4	98	04	19.8	4	44	20.5		19	147	53	50.1	1	45
	5	97	32	44.9	4	47	20.8		20	149	52	32.5	1	44
	6	97	03	46.2	4	48	46.1		21	151	50	06.1	1	42
	7	96	37	54.8	-4	48	37.3		22	153	46	27.3	+1	40
	8	96	15	38.6	4	46	57.0		23	155	41	33.3	1	37
	9	95	57	22.4	4	43	48.3		24	157	35	22.3	1	34
	10	95	43	27.9	4	39	15.5		25	159	27	52.9	1	30
	11	95	34	13.0	4	33	23.3		26	161	19	04.5	1	26
	12	95	29	52.7	4	26	17.2		27	163	08	56.9	1	22
	13	95	30	39.0	-4	18	02.6		28	164	57	30.1	+1	17
	14	95	36	40.9	4	08	45.5		29	166	44	44.5	1	11
	15	95	48	05.0	3	58	31.8		30	168	30	40.7	1	06
	16	96	04	55.9	3	47	27.2		31	170	15	19.5	1	00
	17	96	27	16.1	3	35	37.7	Sept.	1	171	58	41.8	0	54
	18	96	55	06.7	3	23	08.8		2	173	40	48.4	0	48
	19	97	28	27.3	-3	10	06.0		3	175	21	40.5	+0	41
	20	98	07	16.7	2	56	34.7		4	177	01	18.8	0	34
	21	98	51	32.5	2	42	39.9		5	178	39	44.4	0	27
	22	99	41	11.7	2	28	26.6		6	180	16	58.2	0	20
	23	100	36	10.7	2	13	59.6		7	181	53	00.8	0	13
	24	101	36	25.2	1	59	23.6		8	183	27	53.0	+0	05
	25	102	41	50.2	-1	44	43.3		9	185	01	35.3	-0	01
	26	103	52	20.1	1	30	03.1		10	186	34	08.1	0	09
	27	105	07	48.5	1	15	27.5		11	188	05	31.6	0	17
	28	106	28	08.1	1	01	00.9		12	189	35	45.9	0	24
	29	107	53	10.3	0	46	47.9		13	191	04	50.9	0	32
	30	109	22	45.2	0	32	52.7		14	192	32	46.1	0	40
	31	110	56	41.6	-0	19	19.7		15	193	59	30.9	-0	48
Aug.	1	112	34	46.4	-0	06	13.3		16	195	25	04.6	0	56
	2	114	16	45.1	+0	06	22.6		17	196	49	25.9	1	04
	3	116	02	21.2	0	18	24.0		18	198	12	33.3	1	12
	4	117	51	16.7	0	29	47.1		19	199	34	25.2	1	20
	5	119	43	11.9	0	40	28.8		20	200	54	59.3	1	28
	6	121	37	46.3	+0	50	25.9		21	202	14	13.0	-1	35
	7	123	34	38.0	0	59	36.1		22	203	32	03.4	1	43
	8	125	33	25.1	1	07	57.4		23	204	48	26.9	1	51
	9	127	33	45.3	1	15	28.4		24	206	03	19.3	1	58
	10	129	35	17.0	1	22	08.2		25	207	16	36.1	2	06
	11	131	37	39.5	1	27	56.6		26	208	28	11.8	2	13
	12	133	40	33.1	+1	32	53.8		27	209	38	00.5	-2	20
	13	135	43	39.9	1	37	00.3		28	210	45	55.1	2	27
	14	137	46	43.5	1	40	17.4		29	211	51	48.0	2	34
	15	139	49	29.4	1	42	46.5		30	212	55	30.2	2	40
	16	141	51	45.0	+1	44	29.1	Oct.	1	213	56	52.0	-2	46

MERCURY, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Appare Geocent Latituc	
		°	'	"	°	'	"			°	'	"	°	'
Oct.	1	213	56	52.0	-2	46	40.7	Nov.	16	216	09	41.2	+2	06
	2	214	55	42.2	2	52	30.9		17	217	32	09.4	2	02
	3	215	51	48.2	2	58	00.4		18	218	56	44.4	1	57
	4	216	44	56.0	3	03	06.7		19	220	23	05.2	1	52
	5	217	34	50.1	3	07	47.0		20	221	50	53.9	1	46
	6	218	21	12.9	3	11	58.3		21	223	19	55.3	1	40
	7	219	03	45.3	-3	15	37.2		22	224	49	56.4	+1	34
	8	219	42	05.8	3	18	39.7		23	226	20	46.1	1	28
	9	220	15	51.3	3	21	01.6		24	227	52	15.2	1	21
	10	220	44	36.5	3	22	38.1		25	229	24	15.9	1	15
	11	221	07	54.1	3	23	24.0		26	230	56	41.9	1	08
	12	221	25	15.5	3	23	13.4		27	232	29	27.6	1	01
	13	221	36	10.7	-3	22	00.0		28	234	02	28.8	+0	54
	14	221	40	09.5	3	19	36.9		29	235	35	41.8	0	47
	15	221	36	42.2	3	15	57.1		30	237	09	03.8	0	40
	16	221	25	21.4	3	10	53.3	Dec.	1	238	42	32.5	0	33
	17	221	05	44.1	3	04	18.1		2	240	16	06.0	0	26
	18	220	37	33.8	2	56	05.1		3	241	49	43.0	0	19
	19	220	00	43.9	-2	46	08.8		4	243	23	22.6	+0	12
	20	219	15	21.1	2	34	25.7		5	244	57	04.1	+0	05
	21	218	21	48.9	2	20	54.7		6	246	30	47.1	-0	01
	22	217	20	51.0	2	05	38.7		7	248	04	31.4	0	08
	23	216	13	33.1	1	48	44.7		8	249	38	17.3	0	15
	24	215	01	24.1	1	30	24.5		9	251	12	04.7	0	22
	25	213	46	13.8	-1	10	55.0		10	252	45	54.3	-0	28
	26	212	30	09.3	0	50	37.3		11	254	19	46.4	0	35
	27	211	15	27.8	0	29	55.9		12	255	53	41.7	0	41
	28	210	04	28.5	-0	09	17.1		13	257	27	40.9	0	47
	29	208	59	23.6	+0	10	53.3		14	259	01	44.6	0	53
	30	208	02	09.8	0	30	11.1		15	260	35	53.6	0	59
	31	207	14	22.1	+0	48	15.9		16	262	10	08.6	-1	05
Nov.	1	206	37	10.0	1	04	51.4		17	263	44	30.5	1	10
	2	206	11	16.3	1	19	46.4		18	265	19	00.1	1	16
	3	205	56	58.4	1	32	54.0		19	266	53	38.2	1	21
	4	205	54	11.7	1	44	11.7		20	268	28	25.9	1	26
	5	206	02	33.5	1	53	40.5		21	270	03	24.0	1	31
	6	206	21	27.4	+2	01	23.8		22	271	38	33.3	-1	35
	7	206	50	08.0	2	07	27.1		23	273	13	54.6	1	40
	8	207	27	44.3	2	11	56.9		24	274	49	28.8	1	44
	9	208	13	23.0	2	15	00.7		25	276	25	16.7	1	47
	10	209	06	11.1	2	16	46.0		26	278	01	18.8	1	51
	11	210	05	17.4	2	17	20.3		27	279	37	35.6	1	54
	12	211	09	53.9	+2	16	51.0		28	281	14	07.7	-1	57
	13	212	19	16.5	2	15	25.0		29	282	50	55.2	2	00
	14	213	32	45.0	2	13	08.6		30	284	27	58.1	2	02
	15	214	49	43.8	2	10	07.7		31	286	05	16.4	2	04
	16	216	09	41.2	+2	06	27.9		32	287	42	49.5	-2	06

MERCURY, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Jan.	0	18	12	21.48	-24	35	23.3	1.431 445	6.14	2.35	11	37	16
	1	18	19	16.96	24	38	08.5	1.434 024	6.13	2.34	11	40	16
	2	18	26	13.95	24	39	32.3	1.436 054	6.12	2.34	11	43	18
	3	18	33	12.34	24	39	33.7	1.437 534	6.12	2.34	11	46	21
	4	18	40	12.03	24	38	11.4	1.438 463	6.11	2.34	11	49	25
	5	18	47	12.93	24	35	24.6	1.438 837	6.11	2.34	11	52	30
	6	18	54	14.92	-24	31	12.2	1.438 653	6.11	2.34	11	55	36
	7	19	01	17.91	24	25	33.3	1.437 905	6.12	2.34	11	58	44
	8	19	08	21.77	24	18	26.9	1.436 586	6.12	2.34	12	01	52
	9	19	15	26.40	24	09	52.3	1.434 689	6.13	2.34	12	05	01
	10	19	22	31.67	23	59	48.6	1.432 204	6.14	2.35	12	08	10
	11	19	29	37.47	23	48	15.0	1.429 121	6.15	2.35	12	11	20
	12	19	36	43.65	-23	35	10.9	1.425 428	6.17	2.36	12	14	30
	13	19	43	50.09	23	20	35.6	1.421 110	6.19	2.36	12	17	40
	14	19	50	56.64	23	04	28.6	1.416 153	6.21	2.37	12	20	51
	15	19	58	03.15	22	46	49.4	1.410 539	6.23	2.38	12	24	01
	16	20	05	09.46	22	27	37.5	1.404 250	6.26	2.39	12	27	11
	17	20	12	15.41	22	06	52.8	1.397 266	6.29	2.40	12	30	21
	18	20	19	20.80	-21	44	35.0	1.389 564	6.33	2.42	12	33	30
	19	20	26	25.42	21	20	44.3	1.381 122	6.37	2.43	12	36	38
	20	20	33	29.04	20	55	20.8	1.371 914	6.41	2.45	12	39	44
	21	20	40	31.42	20	28	25.0	1.361 915	6.46	2.47	12	42	50
	22	20	47	32.25	19	59	57.6	1.351 096	6.51	2.49	12	45	54
	23	20	54	31.22	19	29	59.6	1.339 429	6.57	2.51	12	48	55
	24	21	01	27.95	-18	58	32.5	1.326 884	6.63	2.53	12	51	54
	25	21	08	22.03	18	25	38.1	1.313 433	6.70	2.56	12	54	51
	26	21	15	12.98	17	51	18.7	1.299 045	6.77	2.59	12	57	43
	27	21	22	00.25	17	15	37.3	1.283 693	6.85	2.62	13	00	32
	28	21	28	43.22	16	38	37.5	1.267 350	6.94	2.65	13	03	16
	29	21	35	21.16	16	00	24.0	1.249 991	7.04	2.69	13	05	55
	30	21	41	53.26	-15	21	02.0	1.231 599	7.14	2.73	13	08	27
	31	21	48	18.57	14	40	38.2	1.212 159	7.25	2.77	13	10	52
Feb.	1	21	54	36.00	13	59	20.5	1.191 664	7.38	2.82	13	13	08
	2	22	00	44.32	13	17	18.0	1.170 120	7.52	2.87	13	15	15
	3	22	06	42.15	12	34	41.6	1.147 540	7.66	2.93	13	17	10
	4	22	12	27.91	11	51	43.9	1.123 957	7.82	2.99	13	18	51
	5	22	17	59.87	-11	08	39.2	1.099 416	8.00	3.06	13	20	18
	6	22	23	16.09	10	25	43.9	1.073 985	8.19	3.13	13	21	28
	7	22	28	14.50	9	43	16.2	1.047 752	8.39	3.21	13	22	19
	8	22	32	52.83	9	01	36.5	1.020 828	8.61	3.29	13	22	49
	9	22	37	08.72	8	21	06.6	0.993 350	8.85	3.38	13	22	55
	10	22	40	59.73	7	42	10.2	0.965 478	9.11	3.48	13	22	34
	11	22	44	23.37	-7	05	12.2	0.937 393	9.38	3.58	13	21	45
	12	22	47	17.25	6	30	38.3	0.909 299	9.67	3.70	13	20	25
	13	22	49	39.07	5	58	54.5	0.881 417	9.98	3.81	13	18	32
	14	22	51	26.80	5	30	26.4	0.853 981	10.30	3.93	13	16	04
	15	22	52	38.75	-5	05	38.5	0.827 231	10.63	4.06	13	12	59

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Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Feb.	15	22	52	38.75	-5	05	38.5	0.827 231	10.63	4.06	13	12	59
	16	22	53	13.68	4	44	53.3	0.801 410	10.97	4.19	13	09	17
	17	22	53	10.96	4	28	30.6	0.776 756	11.32	4.33	13	04	58
	18	22	52	30.65	4	16	46.2	0.753 496	11.67	4.46	13	00	02
	19	22	51	13.60	4	09	50.9	0.731 843	12.02	4.59	12	54	31
	20	22	49	21.54	4	07	49.9	0.711 984	12.35	4.72	12	48	26
	21	22	46	57.13	-4	10	41.7	0.694 082	12.67	4.84	12	41	51
	22	22	44	03.92	4	18	17.5	0.678 269	12.97	4.95	12	34	50
	23	22	40	46.31	4	30	21.5	0.664 642	13.23	5.06	12	27	28
	24	22	37	09.38	4	46	30.2	0.653 262	13.46	5.14	12	19	49
	25	22	33	18.77	5	06	14.2	0.644 151	13.65	5.22	12	11	60
	26	22	29	20.38	5	28	58.8	0.637 298	13.80	5.27	12	04	06
	27	22	25	20.18	-5	54	05.6	0.632 656	13.90	5.31	11	56	13
	28	22	21	23.90	6	20	55.0	0.630 147	13.96	5.33	11	48	26
	29	22	17	36.86	6	48	47.3	0.629 667	13.97	5.34	11	40	51
Mar.	1	22	14	03.76	7	17	04.7	0.631 093	13.93	5.32	11	33	32
	2	22	10	48.58	7	45	12.7	0.634 285	13.86	5.30	11	26	32
	3	22	07	54.48	8	12	40.9	0.639 096	13.76	5.26	11	19	54
	4	22	05	23.85	-8	39	03.6	0.645 373	13.63	5.21	11	13	40
	5	22	03	18.32	9	03	59.8	0.652 965	13.47	5.15	11	07	51
	6	22	01	38.82	9	27	13.0	0.661 725	13.29	5.08	11	02	29
	7	22	00	25.74	9	48	30.9	0.671 512	13.10	5.00	10	57	32
	8	21	59	38.93	10	07	44.8	0.682 194	12.89	4.93	10	53	01
	9	21	59	17.90	10	24	48.8	0.693 651	12.68	4.84	10	48	56
	10	21	59	21.86	-10	39	39.7	0.705 769	12.46	4.76	10	45	15
	11	21	59	49.80	10	52	16.0	0.718 450	12.24	4.68	10	41	57
	12	22	00	40.57	11	02	37.9	0.731 602	12.02	4.59	10	39	01
	13	22	01	52.96	11	10	46.5	0.745 144	11.80	4.51	10	36	27
	14	22	03	25.68	11	16	44.0	0.759 007	11.59	4.43	10	34	12
	15	22	05	17.47	11	20	33.0	0.773 126	11.37	4.35	10	32	15
	16	22	07	27.07	-11	22	16.3	0.787 447	11.17	4.27	10	30	36
	17	22	09	53.26	11	21	57.1	0.801 923	10.97	4.19	10	29	12
	18	22	12	34.89	11	19	38.8	0.816 512	10.77	4.12	10	28	04
	19	22	15	30.86	11	15	24.6	0.831 177	10.58	4.04	10	27	09
	20	22	18	40.14	11	09	17.7	0.845 889	10.40	3.97	10	26	27
	21	22	22	01.77	11	01	21.4	0.860 621	10.22	3.90	10	25	58
	22	22	25	34.89	-10	51	38.6	0.875 349	10.05	3.84	10	25	39
	23	22	29	18.65	10	40	12.3	0.890 055	9.88	3.78	10	25	30
	24	22	33	12.33	10	27	05.4	0.904 723	9.72	3.71	10	25	32
	25	22	37	15.24	10	12	20.4	0.919 337	9.57	3.65	10	25	42
	26	22	41	26.76	9	56	00.0	0.933 886	9.42	3.60	10	26	00
	27	22	45	46.33	9	38	06.6	0.948 360	9.27	3.54	10	26	27
	28	22	50	13.44	-9	18	42.4	0.962 749	9.13	3.49	10	27	00
	29	22	54	47.65	8	57	49.7	0.977 047	9.00	3.44	10	27	41
	30	22	59	28.55	8	35	30.6	0.991 247	8.87	3.39	10	28	28
	31	23	04	15.78	8	11	47.1	1.005 342	8.75	3.34	10	29	22
Apr.	1	23	09	09.03	-7	46	41.0	1.019 327	8.63	3.30	10	30	21

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Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Apr.	1	23	09	09.03	-7	46	41.0	1.019 327	8.63	3.30	10	30	21
	2	23	14	08.02	7	20	14.3	1.033 197	8.51	3.25	10	31	26
	3	23	19	12.54	6	52	28.6	1.046 947	8.40	3.21	10	32	36
	4	23	24	22.37	6	23	25.6	1.060 572	8.29	3.17	10	33	52
	5	23	29	37.35	5	53	07.1	1.074 066	8.19	3.13	10	35	13
	6	23	34	57.37	5	21	34.5	1.087 424	8.09	3.09	10	36	38
	7	23	40	22.32	-4	48	49.3	1.100 639	7.99	3.05	10	38	09
	8	23	45	52.15	4	14	53.1	1.113 703	7.90	3.02	10	39	45
	9	23	51	26.82	3	39	47.4	1.126 608	7.81	2.98	10	41	25
	10	23	57	06.32	3	03	33.6	1.139 345	7.72	2.95	10	43	10
	11	0	02	50.67	2	26	13.2	1.151 903	7.63	2.92	10	45	00
	12	0	08	39.92	1	47	47.7	1.164 268	7.55	2.89	10	46	55
	13	0	14	34.11	-1	08	18.8	1.176 426	7.48	2.86	10	48	55
	14	0	20	33.34	-0	27	48.1	1.188 361	7.40	2.83	10	51	01
	15	0	26	37.72	+0	13	42.8	1.200 053	7.33	2.80	10	53	11
	16	0	32	47.37	0	56	12.0	1.211 483	7.26	2.77	10	55	27
	17	0	39	02.45	1	39	37.6	1.222 626	7.19	2.75	10	57	48
	18	0	45	23.12	2	23	57.5	1.233 454	7.13	2.72	11	00	15
	19	0	51	49.56	+3	09	09.5	1.243 938	7.07	2.70	11	02	48
	20	0	58	21.99	3	55	11.1	1.254 043	7.01	2.68	11	05	27
	21	1	05	00.62	4	41	59.7	1.263 732	6.96	2.66	11	08	12
	22	1	11	45.66	5	29	32.1	1.272 963	6.91	2.64	11	11	04
	23	1	18	37.35	6	17	45.1	1.281 688	6.86	2.62	11	14	03
	24	1	25	35.92	7	06	34.8	1.289 857	6.82	2.60	11	17	09
	25	1	32	41.58	+7	55	57.1	1.297 414	6.78	2.59	11	20	22
	26	1	39	54.55	8	45	47.0	1.304 299	6.74	2.58	11	23	42
	27	1	47	15.01	9	35	59.3	1.310 446	6.71	2.56	11	27	10
	28	1	54	43.11	10	26	27.9	1.315 786	6.68	2.55	11	30	46
	29	2	02	18.97	11	17	05.9	1.320 248	6.66	2.54	11	34	29
	30	2	10	02.64	12	07	45.9	1.323 755	6.64	2.54	11	38	21
May	1	2	17	54.09	+12	58	19.4	1.326 233	6.63	2.53	11	42	20
	2	2	25	53.23	13	48	37.1	1.327 605	6.62	2.53	11	46	27
	3	2	33	59.85	14	38	29.1	1.327 798	6.62	2.53	11	50	41
	4	2	42	13.63	15	27	44.5	1.326 744	6.63	2.53	11	55	03
	5	2	50	34.19	16	16	11.6	1.324 382	6.64	2.54	11	59	31
	6	2	59	00.81	17	03	39.2	1.320 660	6.66	2.54	12	04	05
	7	3	07	32.91	+17	49	54.2	1.315 541	6.68	2.55	12	08	43
	8	3	16	09.59	18	34	44.5	1.309 002	6.72	2.57	12	13	26
	9	3	24	49.88	19	17	57.9	1.301 037	6.76	2.58	12	18	13
	10	3	33	32.69	19	59	22.8	1.291 659	6.81	2.60	12	23	01
	11	3	42	16.81	20	38	48.4	1.280 900	6.87	2.62	12	27	49
	12	3	51	01.01	21	16	04.8	1.268 810	6.93	2.65	12	32	37
	13	3	59	43.97	+21	51	03.6	1.255 457	7.00	2.68	12	37	24
	14	4	08	24.38	22	23	37.8	1.240 922	7.09	2.71	12	42	07
	15	4	17	00.97	22	53	42.1	1.225 301	7.18	2.74	12	46	45
	16	4	25	32.48	23	21	12.7	1.208 696	7.28	2.78	12	51	18
	17	4	33	57.71	+23	46	07.6	1.191 216	7.38	2.82	12	55	43

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		h	m	s	°	'	"		"	"	h	m	s
May	17	4	33	57.71	+23	46	07.6	1.191 216	7.38	2.82	12	55	43
	18	4	42	15.56	24	08	26.0	1.172 973	7.50	2.86	13	00	01
	19	4	50	24.98	24	28	08.9	1.154 076	7.62	2.91	13	04	09
	20	4	58	25.04	24	45	18.3	1.134 636	7.75	2.96	13	08	08
	21	5	06	14.88	24	59	57.2	1.114 754	7.89	3.01	13	11	56
	22	5	13	53.73	25	12	09.6	1.094 530	8.03	3.07	13	15	33
	23	5	21	20.90	+25	22	00.2	1.074 054	8.19	3.13	13	18	57
	24	5	28	35.76	25	29	34.3	1.053 410	8.35	3.19	13	22	09
	25	5	35	37.74	25	34	57.5	1.032 675	8.52	3.25	13	25	07
	26	5	42	26.35	25	38	15.8	1.011 917	8.69	3.32	13	27	52
	27	5	49	01.11	25	39	35.5	0.991 200	8.87	3.39	13	30	22
	28	5	55	21.60	25	39	02.9	0.970 579	9.06	3.46	13	32	38
	29	6	01	27.42	+25	36	44.3	0.950 105	9.26	3.54	13	34	39
	30	6	07	18.20	25	32	46.3	0.929 824	9.46	3.61	13	36	25
	31	6	12	53.56	25	27	15.1	0.909 776	9.67	3.69	13	37	55
June	1	6	18	13.18	25	20	17.1	0.889 998	9.88	3.78	13	39	09
	2	6	23	16.70	25	11	58.7	0.870 523	10.10	3.86	13	40	06
	3	6	28	03.80	25	02	26.1	0.851 382	10.33	3.95	13	40	47
	4	6	32	34.14	+24	51	45.3	0.832 604	10.56	4.04	13	41	12
	5	6	36	47.39	24	40	02.6	0.814 216	10.80	4.13	13	41	18
	6	6	40	43.23	24	27	23.8	0.796 242	11.04	4.22	13	41	08
	7	6	44	21.32	24	13	54.9	0.778 708	11.29	4.31	13	40	39
	8	6	47	41.33	23	59	41.6	0.761 637	11.55	4.41	13	39	52
	9	6	50	42.94	23	44	49.8	0.745 054	11.80	4.51	13	38	46
	10	6	53	25.83	+23	29	25.1	0.728 982	12.06	4.61	13	37	22
	11	6	55	49.72	23	13	33.2	0.713 446	12.33	4.71	13	35	39
	12	6	57	54.33	22	57	19.5	0.698 472	12.59	4.81	13	33	36
	13	6	59	39.43	22	40	49.6	0.684 085	12.86	4.91	13	31	13
	14	7	01	04.82	22	24	09.0	0.670 314	13.12	5.01	13	28	31
	15	7	02	10.38	22	07	23.1	0.657 187	13.38	5.11	13	25	30
	16	7	02	56.05	+21	50	37.4	0.644 734	13.64	5.21	13	22	08
	17	7	03	21.89	21	33	57.3	0.632 987	13.89	5.31	13	18	27
	18	7	03	28.03	21	17	28.1	0.621 980	14.14	5.40	13	14	27
	19	7	03	14.77	21	01	15.3	0.611 747	14.38	5.49	13	10	07
	20	7	02	42.55	20	45	24.1	0.602 322	14.60	5.58	13	05	29
	21	7	01	51.98	20	29	59.9	0.593 744	14.81	5.66	13	00	33
	22	7	00	43.86	+20	15	08.0	0.586 048	15.01	5.73	12	55	21
	23	6	59	19.22	20	00	53.6	0.579 271	15.18	5.80	12	49	52
	24	6	57	39.27	19	47	21.8	0.573 451	15.34	5.86	12	44	10
	25	6	55	45.48	19	34	37.6	0.568 624	15.47	5.91	12	38	14
	26	6	53	39.54	19	22	45.9	0.564 823	15.57	5.95	12	32	08
	27	6	51	23.34	19	11	51.5	0.562 082	15.65	5.98	12	25	52
	28	6	48	58.99	+19	01	58.6	0.560 429	15.69	6.00	12	19	29
	29	6	46	28.76	18	53	11.6	0.559 891	15.71	6.00	12	13	02
	30	6	43	55.06	18	45	34.0	0.560 491	15.69	5.99	12	06	33
July	1	6	41	20.40	18	39	09.3	0.562 247	15.64	5.98	12	00	04
	2	6	38	47.33	+18	34	00.1	0.565 171	15.56	5.95	11	53	38

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		h	m	s	°	'	"		"	"	h	m	s
July	1	6	41	20.40	+18	39	09.3	0.562 247	15.64	5.98	12	00	04
	2	6	38	47.33	18	34	00.1	0.565 171	15.56	5.95	11	53	38
	3	6	36	18.41	18	30	08.7	0.569 273	15.45	5.90	11	47	17
	4	6	33	56.14	18	27	36.4	0.574 556	15.31	5.85	11	41	04
	5	6	31	42.92	18	26	24.0	0.581 018	15.14	5.78	11	35	01
	6	6	29	41.01	18	26	31.3	0.588 653	14.94	5.71	11	29	10
	7	6	27	52.53	+18	27	57.3	0.597 450	14.72	5.62	11	23	33
	8	6	26	19.37	18	30	40.3	0.607 393	14.48	5.53	11	18	13
	9	6	25	03.22	18	34	37.6	0.618 464	14.22	5.43	11	13	10
	10	6	24	05.58	18	39	45.8	0.630 642	13.94	5.33	11	08	25
	11	6	23	27.71	18	46	00.5	0.643 900	13.66	5.22	11	04	01
	12	6	23	10.66	18	53	16.9	0.658 212	13.36	5.10	10	59	58
	13	6	23	15.32	+19	01	29.2	0.673 547	13.06	4.99	10	56	17
	14	6	23	42.36	19	10	31.1	0.689 873	12.75	4.87	10	52	58
	15	6	24	32.33	19	20	15.7	0.707 156	12.44	4.75	10	50	03
	16	6	25	45.61	19	30	35.5	0.725 358	12.12	4.63	10	47	30
	17	6	27	22.47	19	41	22.7	0.744 441	11.81	4.51	10	45	21
	18	6	29	23.07	19	52	28.6	0.764 363	11.51	4.40	10	43	36
	19	6	31	47.49	+20	03	44.4	0.785 079	11.20	4.28	10	42	15
	20	6	34	35.72	20	15	00.7	0.806 539	10.90	4.17	10	41	17
	21	6	37	47.67	20	26	07.8	0.828 691	10.61	4.05	10	40	43
	22	6	41	23.19	20	36	55.5	0.851 476	10.33	3.95	10	40	32
	23	6	45	22.07	20	47	13.2	0.874 830	10.05	3.84	10	40	45
	24	6	49	44.03	20	56	50.2	0.898 683	9.79	3.74	10	41	21
	25	6	54	28.71	+21	05	35.2	0.922 956	9.53	3.64	10	42	19
	26	6	59	35.68	21	13	16.8	0.947 564	9.28	3.55	10	43	39
	27	7	05	04.41	21	19	43.5	0.972 411	9.04	3.46	10	45	21
	28	7	10	54.24	21	24	43.8	0.997 395	8.82	3.37	10	47	23
	29	7	17	04.42	21	28	06.2	1.022 402	8.60	3.29	10	49	46
	30	7	23	34.03	21	29	39.6	1.047 314	8.40	3.21	10	52	28
	31	7	30	22.03	+21	29	13.3	1.072 002	8.20	3.13	10	55	28
Aug.	1	7	37	27.20	21	26	37.4	1.096 333	8.02	3.06	10	58	44
	2	7	44	48.15	21	21	43.1	1.120 171	7.85	3.00	11	02	16
	3	7	52	23.37	21	14	22.6	1.143 381	7.69	2.94	11	06	01
	4	8	00	11.18	21	04	29.9	1.165 828	7.54	2.88	11	09	58
	5	8	08	09.81	20	52	00.6	1.187 385	7.41	2.83	11	14	05
	6	8	16	17.38	+20	36	52.2	1.207 936	7.28	2.78	11	18	21
	7	8	24	31.99	20	19	04.2	1.227 377	7.16	2.74	11	22	42
	8	8	32	51.74	19	58	38.1	1.245 621	7.06	2.70	11	27	08
	9	8	41	14.75	19	35	37.1	1.262 599	6.97	2.66	11	31	36
	10	8	49	39.24	19	10	06.5	1.278 260	6.88	2.63	11	36	05
	11	8	58	03.56	18	42	12.7	1.292 574	6.80	2.60	11	40	33
	12	9	06	26.19	+18	12	03.7	1.305 527	6.74	2.57	11	44	59
	13	9	14	45.80	17	39	48.1	1.317 126	6.68	2.55	11	49	21
	14	9	23	01.23	17	05	35.5	1.327 388	6.63	2.53	11	53	38
	15	9	31	11.50	16	29	35.5	1.336 347	6.58	2.51	11	57	49
	16	9	39	15.82	+15	51	58.2	1.344 043	6.54	2.50	12	01	55

MERCURY, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Aug.	16	9	39	15.82	+15	51	58.2	1.344 043	6.54	2.50	12	01	55
	17	9	47	13.55	15	12	53.3	1.350 528	6.51	2.49	12	05	53
	18	9	55	04.23	14	32	30.4	1.355 854	6.49	2.48	12	09	44
	19	10	02	47.51	13	50	58.7	1.360 081	6.47	2.47	12	13	28
	20	10	10	23.19	13	08	26.9	1.363 266	6.45	2.46	12	17	03
	21	10	17	51.14	12	25	03.3	1.365 470	6.44	2.46	12	20	31
	22	10	25	11.35	+11	40	55.4	1.366 751	6.43	2.46	12	23	51
	23	10	32	23.87	10	56	10.4	1.367 164	6.43	2.46	12	27	04
	24	10	39	28.79	10	10	54.8	1.366 764	6.43	2.46	12	30	09
	25	10	46	26.28	9	25	14.5	1.365 599	6.44	2.46	12	33	06
	26	10	53	16.50	8	39	15.3	1.363 719	6.45	2.46	12	35	56
	27	10	59	59.67	7	53	02.0	1.361 166	6.46	2.47	12	38	40
	28	11	06	36.01	+7	06	39.3	1.357 981	6.48	2.47	12	41	16
	29	11	13	05.76	6	20	11.5	1.354 200	6.49	2.48	12	43	46
	30	11	19	29.15	5	33	42.3	1.349 857	6.51	2.49	12	46	10
	31	11	25	46.43	4	47	15.4	1.344 982	6.54	2.50	12	48	28
Sept.	1	11	31	57.85	4	00	54.0	1.339 602	6.56	2.51	12	50	40
	2	11	38	03.64	3	14	40.9	1.333 742	6.59	2.52	12	52	46
	3	11	44	04.03	+2	28	39.1	1.327 424	6.62	2.53	12	54	48
	4	11	49	59.23	1	42	51.0	1.320 666	6.66	2.54	12	56	44
	5	11	55	49.48	0	57	19.1	1.313 485	6.70	2.56	12	58	35
	6	12	01	34.95	+0	12	05.4	1.305 896	6.73	2.57	13	00	22
	7	12	07	15.83	-0	32	47.8	1.297 913	6.78	2.59	13	02	04
	8	12	12	52.31	1	17	18.6	1.289 546	6.82	2.61	13	03	41
	9	12	18	24.52	-2	01	25.1	1.280 805	6.87	2.62	13	05	15
	10	12	23	52.61	2	45	05.5	1.271 697	6.92	2.64	13	06	44
	11	12	29	16.70	3	28	18.0	1.262 230	6.97	2.66	13	08	10
	12	12	34	36.89	4	11	00.8	1.252 409	7.02	2.68	13	09	31
	13	12	39	53.27	4	53	12.4	1.242 239	7.08	2.70	13	10	49
	14	12	45	05.90	5	34	50.9	1.231 722	7.14	2.73	13	12	03
	15	12	50	14.81	-6	15	54.6	1.220 862	7.20	2.75	13	13	14
	16	12	55	20.03	6	56	21.9	1.209 660	7.27	2.78	13	14	20
	17	13	00	21.55	7	36	10.9	1.198 117	7.34	2.80	13	15	23
	18	13	05	19.35	8	15	19.9	1.186 236	7.41	2.83	13	16	22
	19	13	10	13.35	8	53	47.0	1.174 016	7.49	2.86	13	17	18
	20	13	15	03.48	9	31	30.3	1.161 457	7.57	2.89	13	18	09
	21	13	19	49.62	-10	08	27.7	1.148 560	7.66	2.93	13	18	57
	22	13	24	31.60	10	44	37.1	1.135 326	7.75	2.96	13	19	40
	23	13	29	09.23	11	19	56.1	1.121 756	7.84	3.00	13	20	18
	24	13	33	42.27	11	54	22.5	1.107 851	7.94	3.03	13	20	52
	25	13	38	10.44	12	27	53.5	1.093 611	8.04	3.07	13	21	21
	26	13	42	33.40	13	00	26.3	1.079 041	8.15	3.11	13	21	44
	27	13	46	50.77	-13	31	58.0	1.064 143	8.26	3.16	13	22	02
	28	13	51	02.10	14	02	25.3	1.048 921	8.38	3.20	13	22	13
	29	13	55	06.88	14	31	44.6	1.033 382	8.51	3.25	13	22	17
	30	13	59	04.51	14	59	52.1	1.017 534	8.64	3.30	13	22	14
Oct.	1	14	02	54.33	-15	26	43.4	1.001 386	8.78	3.36	13	22	03

MERCURY, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Oct.	1	14	02	54.33	-15	26	43.4	1.001 386	8.78	3.36	13	22	03
	2	14	06	35.58	15	52	13.8	0.984 951	8.93	3.41	13	21	42
	3	14	10	07.42	16	16	18.3	0.968 245	9.08	3.47	13	21	12
	4	14	13	28.87	16	38	50.9	0.951 288	9.24	3.53	13	20	30
	5	14	16	38.89	16	59	45.4	0.934 104	9.41	3.60	13	19	37
	6	14	19	36.26	17	18	54.6	0.916 723	9.59	3.67	13	18	30
	7	14	22	19.69	-17	36	10.6	0.899 180	9.78	3.74	13	17	09
	8	14	24	47.72	17	51	24.6	0.881 520	9.98	3.81	13	15	31
	9	14	26	58.78	18	04	26.8	0.863 794	10.18	3.89	13	13	36
	10	14	28	51.17	18	15	06.5	0.846 066	10.39	3.97	13	11	21
	11	14	30	23.09	18	23	11.6	0.828 407	10.62	4.06	13	08	45
	12	14	31	32.66	18	28	29.1	0.810 907	10.84	4.14	13	05	45
	13	14	32	17.93	-18	30	44.9	0.793 667	11.08	4.23	13	02	20
	14	14	32	36.99	18	29	43.8	0.776 805	11.32	4.33	12	58	28
	15	14	32	28.02	18	25	10.2	0.760 461	11.56	4.42	12	54	08
	16	14	31	49.39	18	16	48.4	0.744 790	11.81	4.51	12	49	17
	17	14	30	39.82	18	04	23.4	0.729 972	12.05	4.60	12	43	55
	18	14	28	58.53	17	47	42.0	0.716 204	12.28	4.69	12	38	02
	19	14	26	45.44	-17	26	34.3	0.703 704	12.50	4.77	12	31	38
	20	14	24	01.36	17	00	56.0	0.692 708	12.70	4.85	12	24	44
	21	14	20	48.23	16	30	49.9	0.683 460	12.87	4.92	12	17	23
	22	14	17	09.19	15	56	28.8	0.676 209	13.01	4.97	12	09	38
	23	14	13	08.78	15	18	17.1	0.671 196	13.10	5.01	12	01	35
	24	14	08	52.79	14	36	52.3	0.668 646	13.15	5.03	11	53	21
	25	14	04	28.21	-13	53	05.1	0.668 747	13.15	5.02	11	45	01
	26	14	00	02.82	13	07	57.8	0.671 645	13.09	5.00	11	36	44
	27	13	55	44.84	12	22	41.5	0.677 425	12.98	4.96	11	28	39
	28	13	51	42.41	11	38	31.2	0.686 106	12.82	4.90	11	20	53
	29	13	48	03.06	10	56	40.7	0.697 638	12.61	4.82	11	13	32
	30	13	44	53.30	10	18	17.5	0.711 899	12.35	4.72	11	06	43
	31	13	42	18.30	-9	44	18.5	0.728 705	12.07	4.61	11	00	31
Nov.	1	13	40	21.73	9	15	27.1	0.747 817	11.76	4.49	10	54	57
	2	13	39	05.72	8	52	12.0	0.768 957	11.44	4.37	10	50	04
	3	13	38	30.99	8	34	47.6	0.791 821	11.11	4.24	10	45	52
	4	13	38	37.04	8	23	15.4	0.816 093	10.78	4.12	10	42	20
	5	13	39	22.40	8	17	26.3	0.841 456	10.45	3.99	10	39	26
	6	13	40	44.87	-8	17	02.9	0.867 607	10.14	3.87	10	37	07
	7	13	42	41.77	8	21	42.0	0.894 260	9.83	3.76	10	35	22
	8	13	45	10.18	8	30	56.7	0.921 156	9.55	3.65	10	34	07
	9	13	48	07.05	8	44	18.4	0.948 066	9.28	3.54	10	33	19
	10	13	51	29.39	9	01	18.1	0.974 788	9.02	3.45	10	32	55
	11	13	55	14.34	9	21	27.4	1.001 154	8.78	3.36	10	32	52
	12	13	59	19.23	-9	44	19.2	1.027 024	8.56	3.27	10	33	09
	13	14	03	41.63	10	09	28.4	1.052 283	8.36	3.19	10	33	42
	14	14	08	19.34	10	36	31.6	1.076 843	8.17	3.12	10	34	29
	15	14	13	10.42	11	05	08.1	1.100 634	7.99	3.05	10	35	29
	16	14	18	13.16	-11	34	58.9	1.123 608	7.83	2.99	10	36	40

MERCURY, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Nov.	16	14	18	13.16	-11	34	58.9	1.123 608	7.83	2.99	10	36	40
	17	14	23	26.06	12	05	47.1	1.145 730	7.68	2.93	10	38	00
	18	14	28	47.84	12	37	17.9	1.166 978	7.54	2.88	10	39	29
	19	14	34	17.39	13	09	18.1	1.187 342	7.41	2.83	10	41	05
	20	14	39	53.76	13	41	36.0	1.206 817	7.29	2.78	10	42	48
	21	14	45	36.16	14	14	01.5	1.225 409	7.18	2.74	10	44	37
	22	14	51	23.92	-14	46	25.6	1.243 126	7.07	2.70	10	46	30
	23	14	57	16.46	15	18	40.4	1.259 980	6.98	2.67	10	48	28
	24	15	03	13.30	15	50	38.9	1.275 986	6.89	2.63	10	50	31
	25	15	09	14.06	16	22	15.2	1.291 163	6.81	2.60	10	52	37
	26	15	15	18.40	16	53	23.8	1.305 527	6.74	2.57	10	54	46
	27	15	21	26.04	17	23	59.9	1.319 099	6.67	2.55	10	56	59
	28	15	27	36.75	-17	53	59.2	1.331 897	6.60	2.52	10	59	15
	29	15	33	50.36	18	23	18.1	1.343 940	6.54	2.50	11	01	33
	30	15	40	06.71	18	51	53.0	1.355 247	6.49	2.48	11	03	54
Dec.	1	15	46	25.66	19	19	41.0	1.365 836	6.44	2.46	11	06	18
	2	15	52	47.11	19	46	39.1	1.375 725	6.39	2.44	11	08	44
	3	15	59	10.98	20	12	44.8	1.384 929	6.35	2.43	11	11	13
	4	16	05	37.19	-20	37	55.8	1.393 464	6.31	2.41	11	13	44
	5	16	12	05.68	21	02	09.9	1.401 344	6.28	2.40	11	16	17
	6	16	18	36.40	21	25	25.1	1.408 583	6.24	2.39	11	18	53
	7	16	25	09.30	21	47	39.3	1.415 193	6.21	2.37	11	21	30
	8	16	31	44.34	22	08	50.8	1.421 185	6.19	2.36	11	24	10
	9	16	38	21.48	22	28	57.9	1.426 569	6.16	2.36	11	26	52
	10	16	45	00.69	-22	47	58.8	1.431 354	6.14	2.35	11	29	36
	11	16	51	41.94	23	05	52.1	1.435 547	6.13	2.34	11	32	22
	12	16	58	25.17	23	22	36.1	1.439 155	6.11	2.33	11	35	10
	13	17	05	10.35	23	38	09.4	1.442 184	6.10	2.33	11	37	60
	14	17	11	57.43	23	52	30.6	1.444 639	6.09	2.33	11	40	52
	15	17	18	46.35	24	05	38.2	1.446 523	6.08	2.32	11	43	45
	16	17	25	37.06	-24	17	31.0	1.447 838	6.07	2.32	11	46	41
	17	17	32	29.49	24	28	07.4	1.448 587	6.07	2.32	11	49	38
	18	17	39	23.58	24	37	26.3	1.448 770	6.07	2.32	11	52	36
	19	17	46	19.25	24	45	26.3	1.448 387	6.07	2.32	11	55	37
	20	17	53	16.41	24	52	06.1	1.447 435	6.08	2.32	11	58	38
	21	18	00	15.00	24	57	24.5	1.445 913	6.08	2.32	12	01	41
	22	18	07	14.89	-25	01	20.3	1.443 817	6.09	2.33	12	04	46
	23	18	14	16.01	25	03	52.3	1.441 141	6.10	2.33	12	07	51
	24	18	21	18.24	25	04	59.5	1.437 879	6.12	2.34	12	10	58
	25	18	28	21.45	25	04	40.6	1.434 024	6.13	2.34	12	14	05
	26	18	35	25.53	25	02	54.7	1.429 568	6.15	2.35	12	17	14
	27	18	42	30.31	24	59	40.7	1.424 500	6.17	2.36	12	20	23
	28	18	49	35.66	-24	54	57.7	1.418 809	6.20	2.37	12	23	32
	29	18	56	41.41	24	48	44.7	1.412 483	6.23	2.38	12	26	42
	30	19	03	47.36	24	41	01.1	1.405 508	6.26	2.39	12	29	52
	31	19	10	53.33	24	31	45.9	1.397 870	6.29	2.40	12	33	01
	32	19	17	59.09	-24	20	58.7	1.389 550	6.33	2.42	12	36	11

VENUS, 2020
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude			Heliocentric Latitude			Radius Vector	Date		Heliocentric Longitude			Heliocentric Latitude			Radius Vector
		°	'	"	°	'	"				°	'	"	°	'	"	
Jan.	1	4	26	07.4	-3	14	12.6	0.726 2658	Apr.	2	152	40	29.1	+3	17	29.8	0.718 7671
	3	7	37	08.9	3	10	30.1	0.726 0446		4	155	55	28.3	3	20	00.2	0.718 8719
	5	10	48	16.1	3	06	12.2	0.725 8149		6	159	10	24.7	3	21	52.2	0.718 9908
	7	13	59	29.0	3	01	19.7	0.725 5773		8	162	25	17.7	3	23	05.2	0.719 1233
	9	17	10	47.7	2	55	53.4	0.725 3326		10	165	40	06.5	3	23	39.1	0.719 2691
	11	20	22	12.3	2	49	54.1	0.725 0816		12	168	54	50.5	3	23	34.0	0.719 4278
	13	23	33	42.9	-2	43	23.1	0.724 8251		14	172	09	28.9	+3	22	49.8	0.719 5987
	15	26	45	19.5	2	36	21.4	0.724 5637		16	175	24	01.2	3	21	26.7	0.719 7813
	17	29	57	02.3	2	28	50.3	0.724 2984		18	178	38	26.7	3	19	25.1	0.719 9751
	19	33	08	51.4	2	20	51.1	0.724 0300		20	181	52	44.8	3	16	45.4	0.720 1794
	21	36	20	46.7	2	12	25.2	0.723 7592		22	185	06	55.0	3	13	28.3	0.720 3936
	23	39	32	48.5	2	03	34.2	0.723 4870		24	188	20	56.7	3	09	34.3	0.720 6169
	25	42	44	56.8	-1	54	19.7	0.723 2142		26	191	34	49.6	+3	05	04.4	0.720 8487
	27	45	57	11.6	1	44	43.3	0.722 9416		28	194	48	33.0	2	59	59.4	0.721 0883
	29	49	09	33.2	1	34	46.8	0.722 6701		30	198	02	06.8	2	54	20.5	0.721 3348
	31	52	22	01.6	1	24	32.1	0.722 4006	May	2	201	15	30.5	2	48	08.8	0.721 5875
Feb.	2	55	34	36.8	1	14	01.0	0.722 1339		4	204	28	43.8	2	41	25.5	0.721 8456
	4	58	47	18.9	1	03	15.5	0.721 8708		6	207	41	46.6	2	34	12.0	0.722 1082
	6	62	00	08.1	-0	52	17.7	0.721 6122		8	210	54	38.6	+2	26	29.7	0.722 3747
	8	65	13	04.3	0	41	09.5	0.721 3589		10	214	07	19.9	2	18	20.2	0.722 6440
	10	68	26	07.7	0	29	53.0	0.721 1116		12	217	19	50.2	2	09	45.0	0.722 9153
	12	71	39	18.3	0	18	30.4	0.720 8713		14	220	32	09.6	2	00	45.8	0.723 1879
	14	74	52	36.0	-0	07	03.9	0.720 6386		16	223	44	18.1	1	51	24.5	0.723 4609
	16	78	06	01.0	+0	04	24.4	0.720 4144		18	226	56	15.8	1	41	42.7	0.723 7334
	18	81	19	33.1	+0	15	52.4	0.720 1992		20	230	08	03.1	+1	31	42.4	0.724 0045
	20	84	33	12.4	0	27	17.6	0.719 9939		22	233	19	39.8	1	21	25.4	0.724 2735
	22	87	46	58.8	0	38	38.1	0.719 7990		24	236	31	06.5	1	10	53.7	0.724 5396
	24	91	00	52.1	0	49	51.5	0.719 6152		26	239	42	23.4	1	00	09.4	0.724 8018
	26	94	14	52.3	1	00	55.8	0.719 4431		28	242	53	30.7	0	49	14.3	0.725 0594
	28	97	28	59.2	1	11	48.7	0.719 2833		30	246	04	29.0	0	38	10.6	0.725 3116
Mar.	1	100	43	12.5	+1	22	28.2	0.719 1362	June	1	249	15	18.5	+0	27	00.3	0.725 5576
	3	103	57	32.2	1	32	52.1	0.719 0024		3	252	25	59.8	0	15	45.4	0.725 7967
	5	107	11	57.8	1	42	58.4	0.718 8822		5	255	36	33.4	+0	04	28.1	0.726 0282
	7	110	26	29.2	1	52	45.2	0.718 7761		7	258	46	59.7	-0	06	49.6	0.726 2513
	9	113	41	05.9	2	02	10.5	0.718 6844		9	261	57	19.3	0	18	05.7	0.726 4653
	11	116	55	47.5	2	11	12.4	0.718 6074		11	265	07	32.8	0	29	18.1	0.726 6697
	13	120	10	33.7	+2	19	49.2	0.718 5454		13	268	17	40.5	-0	40	24.7	0.726 8637
	15	123	25	24.0	2	27	59.2	0.718 4985		15	271	27	43.2	0	51	23.6	0.727 0469
	17	126	40	17.9	2	35	40.8	0.718 4669		17	274	37	41.5	1	02	12.7	0.727 2186
	19	129	55	14.9	2	42	52.4	0.718 4508		19	277	47	35.8	1	12	50.1	0.727 3783
	21	133	10	14.4	2	49	32.6	0.718 4501		21	280	57	26.8	1	23	14.0	0.727 5255
	23	136	25	15.7	2	55	40.1	0.718 4648		23	284	07	15.0	1	33	22.3	0.727 6598
	25	139	40	18.4	+3	01	13.8	0.718 4950		25	287	17	01.0	-1	43	13.5	0.727 7808
	27	142	55	21.8	3	06	12.5	0.718 5405		27	290	26	45.4	1	52	45.5	0.727 8880
	29	146	10	25.1	3	10	35.3	0.718 6012		29	293	36	28.6	2	01	56.9	0.727 9813
	31	149	25	27.8	3	14	21.3	0.718 6768	July	1	296	46	11.3	2	10	45.8	0.728 0602
Apr.	2	152	40	29.1	+3	17	29.8	0.718 7671		3	299	55	53.9	-2	19	10.8	0.728 1246

VENUS, 2020
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude			Heliocentric Latitude			Radius Vector	Date		Heliocentric Longitude			Heliocentric Latitude			Radius Vector
		°	′	″	°	′	″				°	′	″	°	′	″	
July	1	296	46	11.3	-2	10	45.8	0.728 0602	Oct.	1	83	25	22.4	+0	23	16.9	0.720 0601
	3	299	55	53.9	2	19	10.8	0.728 1246		3	86	39	06.5	0	34	39.3	0.719 8592
	5	303	05	36.9	2	27	10.3	0.728 1742		5	89	52	57.6	0	45	55.5	0.719 6692
	7	306	15	20.8	2	34	42.9	0.728 2090		7	93	06	55.7	0	57	03.2	0.719 4907
	9	309	25	06.0	2	41	47.3	0.728 2287		9	96	21	00.7	1	08	00.4	0.719 3243
	11	312	34	53.0	2	48	22.1	0.728 2333		11	99	35	12.2	1	18	44.9	0.719 1705
	13	315	44	42.0	-2	54	26.1	0.728 2229		13	102	49	30.2	+1	29	14.5	0.719 0298
	15	318	54	33.7	2	59	58.4	0.728 1973		15	106	03	54.4	1	39	27.3	0.718 9027
	17	322	04	28.1	3	04	57.8	0.728 1568		17	109	18	24.5	1	49	21.2	0.718 7896
	19	325	14	25.7	3	09	23.4	0.728 1014		19	112	33	00.1	1	58	54.3	0.718 6909
	21	328	24	26.8	3	13	14.4	0.728 0313		21	115	47	40.8	2	08	04.7	0.718 6069
	23	331	34	31.7	3	16	30.1	0.727 9467		23	119	02	26.3	2	16	50.5	0.718 5378
	25	334	44	40.5	-3	19	09.9	0.727 8478		25	122	17	16.2	+2	25	10.1	0.718 4839
	27	337	54	53.5	3	21	13.3	0.727 7350		27	125	32	09.9	2	33	01.9	0.718 4454
	29	341	05	11.0	3	22	39.8	0.727 6085		29	128	47	06.9	2	40	24.2	0.718 4223
	31	344	15	33.1	3	23	29.2	0.727 4687		31	132	02	06.6	2	47	15.7	0.718 4148
Aug.	2	347	26	00.0	3	23	41.2	0.727 3162	Nov.	2	135	17	08.5	2	53	34.9	0.718 4229
	4	350	36	31.9	3	23	15.8	0.727 1512		4	138	32	12.0	2	59	20.6	0.718 4465
	6	353	47	08.8	-3	22	13.0	0.726 9744		6	141	47	16.4	+3	04	31.7	0.718 4857
	8	356	57	50.9	3	20	32.9	0.726 7863		8	145	02	21.1	3	09	07.2	0.718 5401
	10	360	08	38.3	3	18	15.8	0.726 5873		10	148	17	25.3	3	13	06.2	0.718 6098
	12	3	19	31.2	3	15	22.1	0.726 3782		12	151	32	28.4	3	16	28.0	0.718 6944
	14	6	30	29.7	3	11	52.1	0.726 1596		14	154	47	29.7	3	19	11.8	0.718 7937
	16	9	41	33.7	3	07	46.6	0.725 9321		16	158	02	28.5	3	21	17.3	0.718 9073
	18	12	52	43.4	-3	03	06.2	0.725 6964		18	161	17	24.1	+3	22	44.0	0.719 0349
	20	16	03	59.0	2	57	51.6	0.725 4532		20	164	32	15.8	3	23	31.7	0.719 1760
	22	19	15	20.5	2	52	03.9	0.725 2033		22	167	47	02.9	3	23	40.2	0.719 3303
	24	22	26	47.9	2	45	43.9	0.724 9475		24	171	01	44.6	3	23	09.6	0.719 4971
	26	25	38	21.4	2	38	52.9	0.724 6865		26	174	16	20.4	3	22	00.1	0.719 6760
	28	28	50	01.1	2	31	32.0	0.724 4212		28	177	30	49.6	3	20	11.9	0.719 8664
	30	32	01	47.0	-2	23	42.5	0.724 1523		30	180	45	11.7	+3	17	45.5	0.720 0677
Sept.	1	35	13	39.2	2	15	25.9	0.723 8808	Dec.	2	183	59	25.9	3	14	41.3	0.720 2792
	3	38	25	37.9	2	06	43.6	0.723 6074		4	187	13	31.9	3	11	00.1	0.720 5002
	5	41	37	43.1	1	57	37.2	0.723 3329		6	190	27	29.1	3	06	42.7	0.720 7301
	7	44	49	54.9	1	48	08.3	0.723 0584		8	193	41	17.0	3	01	49.8	0.720 9681
	9	48	02	13.5	1	38	18.8	0.722 7845		10	196	54	55.3	2	56	22.6	0.721 2134
	11	51	14	38.8	-1	28	10.3	0.722 5123		12	200	08	23.6	+2	50	22.1	0.721 4652
	13	54	27	11.1	1	17	44.8	0.722 2425		14	203	21	41.6	2	43	49.6	0.721 7228
	15	57	39	50.3	1	07	04.2	0.721 9759		16	206	34	49.1	2	36	46.5	0.721 9854
	17	60	52	36.6	0	56	10.4	0.721 7135		18	209	47	45.8	2	29	14.0	0.722 2520
	19	64	05	29.9	0	45	05.6	0.721 4561		20	213	00	31.7	2	21	13.7	0.722 5219
	21	67	18	30.5	0	33	51.9	0.721 2044		22	216	13	06.6	2	12	47.3	0.722 7942
	23	70	31	38.4	-0	22	31.2	0.720 9593		24	219	25	30.5	+2	03	56.3	0.723 0681
	25	73	44	53.5	-0	11	05.8	0.720 7216		26	222	37	43.5	1	54	42.4	0.723 3427
	27	76	58	15.9	+0	00	22.1	0.720 4920		28	225	49	45.6	1	45	07.6	0.723 6171
	29	80	11	45.5	0	11	50.4	0.720 2713		30	229	01	37.1	1	35	13.4	0.723 8905
Oct.	1	83	25	22.4	+0	23	16.9	0.720 0601		32	232	13	18.0	+1	25	02.1	0.724 1620

VENUS, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Jan.	0	313	10	56.8	-1	50	47.8	Feb.	15	8	21	49.8	-0	00	58.5
	1	314	24	30.7	1	50	20.6		16	9	31	17.6	+0	03	11.9
	2	315	38	01.9	1	49	48.2		17	10	40	36.5	0	07	25.7
	3	316	51	30.4	1	49	10.5		18	11	49	46.0	0	11	42.8
	4	318	04	55.9	1	48	27.5		19	12	58	46.1	0	16	03.0
	5	319	18	18.5	1	47	39.1		20	14	07	36.5	0	20	26.3
	6	320	31	38.0	-1	46	45.5		21	15	16	16.8	+0	24	52.5
	7	321	44	54.3	1	45	46.5		22	16	24	46.8	0	29	21.6
	8	322	58	07.3	1	44	42.1		23	17	33	06.2	0	33	53.4
	9	324	11	16.9	1	43	32.4		24	18	41	14.6	0	38	27.8
	10	325	24	23.0	1	42	17.2		25	19	49	11.9	0	43	04.7
	11	326	37	25.5	1	40	56.8		26	20	56	57.5	0	47	43.9
	12	327	50	24.4	-1	39	30.9		27	22	04	31.3	+0	52	25.4
	13	329	03	19.4	1	37	59.7		28	23	11	52.8	0	57	09.0
	14	330	16	10.6	1	36	23.2		29	24	19	01.7	1	01	54.6
	15	331	28	57.8	1	34	41.3	Mar.	1	25	25	57.6	1	06	42.0
	16	332	41	41.2	1	32	54.1		2	26	32	40.2	1	11	31.0
	17	333	54	20.6	1	31	01.6		3	27	39	08.9	1	16	21.7
	18	335	06	56.0	-1	29	03.9		4	28	45	23.4	+1	21	13.7
	19	336	19	27.3	1	27	00.8		5	29	51	23.1	1	26	06.9
	20	337	31	54.5	1	24	52.6		6	30	57	07.8	1	31	01.2
	21	338	44	17.3	1	22	39.1		7	32	02	36.8	1	35	56.5
	22	339	56	35.7	1	20	20.4		8	33	07	49.7	1	40	52.5
	23	341	08	49.5	1	17	56.6		9	34	12	46.0	1	45	49.0
	24	342	20	58.6	-1	15	27.6		10	35	17	25.4	+1	50	46.0
	25	343	33	02.6	1	12	53.6		11	36	21	47.4	1	55	43.2
	26	344	45	01.6	1	10	14.5		12	37	25	51.7	2	00	40.4
	27	345	56	55.2	1	07	30.3		13	38	29	37.8	2	05	37.6
	28	347	08	43.2	1	04	41.2		14	39	33	05.5	2	10	34.5
	29	348	20	25.6	1	01	47.1		15	40	36	14.1	2	15	30.9
	30	349	32	02.1	-0	58	48.2		16	41	39	03.2	+2	20	26.7
	31	350	43	32.6	0	55	44.5		17	42	41	32.3	2	25	21.7
Feb.	1	351	54	56.8	0	52	35.9		18	43	43	40.8	2	30	15.8
	2	353	06	14.5	0	49	22.7		19	44	45	28.1	2	35	08.7
	3	354	17	25.7	0	46	04.9		20	45	46	53.5	2	40	00.3
	4	355	28	30.0	0	42	42.4		21	46	47	56.4	2	44	50.4
	5	356	39	27.3	-0	39	15.5		22	47	48	36.0	+2	49	38.8
	6	357	50	17.3	0	35	44.2		23	48	48	51.6	2	54	25.4
	7	359	00	59.9	0	32	08.6		24	49	48	42.4	2	59	09.8
	8	0	11	34.8	0	28	28.7		25	50	48	07.7	3	03	52.0
	9	1	22	01.7	0	24	44.6		26	51	47	06.5	3	08	31.7
	10	2	32	20.7	0	20	56.5		27	52	45	37.9	3	13	08.7
	11	3	42	31.4	-0	17	04.4		28	53	43	41.0	+3	17	42.7
	12	4	52	33.8	0	13	08.5		29	54	41	14.8	3	22	13.7
	13	6	02	27.7	0	09	08.8		30	55	38	18.3	3	26	41.2
	14	7	12	13.1	0	05	05.4		31	56	34	50.2	3	31	05.1
	15	8	21	49.8	-0	00	58.5	Apr.	1	57	30	49.4	+3	35	25.1

VENUS, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Apr.	1	57	30	49.4	+3	35	25.1	May	17	81	33	55.4	+3	51	08.2
	2	58	26	14.8	3	39	41.0		18	81	23	48.4	3	43	40.9
	3	59	21	05.0	3	43	52.5		19	81	11	16.5	3	35	42.1
	4	60	15	18.7	3	47	59.2		20	80	56	21.1	3	27	11.7
	5	61	08	54.6	3	52	01.0		21	80	39	03.9	3	18	09.6
	6	62	01	51.2	3	55	57.6		22	80	19	27.7	3	08	36.0
	7	62	54	07.2	+3	59	48.5		23	79	57	36.2	+2	58	31.2
	8	63	45	41.2	4	03	33.6		24	79	33	34.2	2	47	56.0
	9	64	36	31.7	4	07	12.4		25	79	07	27.4	2	36	51.1
	10	65	26	37.4	4	10	44.7		26	78	39	22.7	2	25	17.7
	11	66	15	56.7	4	14	10.1		27	78	09	27.9	2	13	17.4
	12	67	04	28.0	4	17	28.4		28	77	37	52.2	2	00	51.8
	13	67	52	09.7	+4	20	39.0		29	77	04	45.7	+1	48	02.9
	14	68	38	59.9	4	23	41.8		30	76	30	19.6	1	34	53.2
	15	69	24	56.7	4	26	36.3		31	75	54	46.1	1	21	25.2
	16	70	09	58.3	4	29	22.2	June	1	75	18	18.2	1	07	41.7
	17	70	54	02.5	4	31	59.0		2	74	41	09.8	0	53	45.8
	18	71	37	07.2	4	34	26.4		3	74	03	35.2	0	39	40.7
	19	72	19	10.1	+4	36	43.8		4	73	25	49.4	+0	25	29.8
	20	73	00	08.8	4	38	51.0		5	72	48	07.2	+0	11	16.6
	21	73	40	01.0	4	40	47.2		6	72	10	43.7	-0	02	55.6
	22	74	18	43.9	4	42	32.2		7	71	33	53.6	0	17	03.2
	23	74	56	14.9	4	44	05.2		8	70	57	51.0	0	31	03.0
	24	75	32	31.1	4	45	25.9		9	70	22	49.5	0	44	51.7
	25	76	07	29.6	+4	46	33.6		10	69	49	01.9	-0	58	26.3
	26	76	41	07.3	4	47	27.7		11	69	16	40.0	1	11	44.2
	27	77	13	20.9	4	48	07.6		12	68	45	54.5	1	24	42.7
	28	77	44	07.2	4	48	32.5		13	68	16	55.2	1	37	19.6
	29	78	13	22.6	4	48	41.9		14	67	49	50.4	1	49	33.0
	30	78	41	03.7	4	48	34.9		15	67	24	47.6	2	01	21.2
May	1	79	07	06.8	+4	48	10.8		16	67	01	53.0	-2	12	42.9
	2	79	31	28.2	4	47	28.7		17	66	41	11.6	2	23	36.9
	3	79	54	04.1	4	46	28.0		18	66	22	47.4	2	34	02.4
	4	80	14	50.9	4	45	07.6		19	66	06	43.4	2	43	58.8
	5	80	33	44.7	4	43	26.7		20	65	53	01.6	2	53	25.8
	6	80	50	42.1	4	41	24.4		21	65	41	42.9	3	02	23.1
	7	81	05	39.4	+4	38	59.8		22	65	32	47.9	-3	10	51.0
	8	81	18	33.2	4	36	11.9		23	65	26	16.0	3	18	49.4
	9	81	29	20.2	4	32	59.9		24	65	22	06.3	3	26	18.7
	10	81	37	57.1	4	29	22.8		25	65	20	17.2	3	33	19.5
	11	81	44	21.1	4	25	19.6		26	65	20	46.8	3	39	52.1
	12	81	48	29.2	4	20	49.6		27	65	23	33.0	3	45	57.2
	13	81	50	18.9	+4	15	51.9		28	65	28	33.0	-3	51	35.5
	14	81	49	48.0	4	10	25.6		29	65	35	44.2	3	56	47.6
	15	81	46	54.7	4	04	30.0		30	65	45	03.6	4	01	34.4
	16	81	41	37.4	3	58	04.4	July	1	65	56	28.1	4	05	56.4
	17	81	33	55.4	+3	51	08.2		2	66	09	54.6	-4	09	54.7

VENUS, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
July	1	65	56	28.1	-4	05	56.4	Aug.	16	97	54	46.7	-3	06	29.8
	2	66	09	54.6	4	09	54.7		17	98	53	38.0	3	02	16.0
	3	66	25	19.6	4	13	29.8		18	99	52	52.7	2	57	59.2
	4	66	42	39.7	4	16	42.6		19	100	52	30.2	2	53	39.8
	5	67	01	51.6	4	19	33.9		20	101	52	29.5	2	49	17.9
	6	67	22	51.7	4	22	04.5		21	102	52	50.1	2	44	53.7
	7	67	45	36.4	-4	24	15.1		22	103	53	31.4	-2	40	27.4
	8	68	10	02.2	4	26	06.6		23	104	54	32.7	2	35	59.1
	9	68	36	05.6	4	27	39.5		24	105	55	53.6	2	31	29.1
	10	69	03	43.1	4	28	54.8		25	106	57	33.7	2	26	57.4
	11	69	32	51.4	4	29	53.0		26	107	59	32.4	2	22	24.4
	12	70	03	27.1	4	30	34.9		27	109	01	49.4	2	17	50.0
	13	70	35	26.9	-4	31	01.2		28	110	04	24.1	-2	13	14.6
	14	71	08	47.7	4	31	12.4		29	111	07	16.3	2	08	38.2
	15	71	43	26.4	4	31	09.1		30	112	10	25.6	2	04	01.1
	16	72	19	19.9	4	30	52.1		31	113	13	51.5	1	59	23.3
	17	72	56	25.4	4	30	21.7	Sept.	1	114	17	33.7	1	54	45.1
	18	73	34	40.1	4	29	38.7		2	115	21	31.9	1	50	06.6
	19	74	14	01.1	-4	28	43.4		3	116	25	45.8	-1	45	28.0
	20	74	54	26.0	4	27	36.4		4	117	30	15.0	1	40	49.4
	21	75	35	52.2	4	26	18.3		5	118	34	59.3	1	36	10.9
	22	76	18	17.2	4	24	49.3		6	119	39	58.2	1	31	32.8
	23	77	01	38.7	4	23	10.1		7	120	45	11.6	1	26	55.2
	24	77	45	54.7	4	21	20.9		8	121	50	39.1	1	22	18.3
	25	78	31	03.1	-4	19	22.2		9	122	56	20.4	-1	17	42.1
	26	79	17	01.9	4	17	14.4		10	124	02	15.1	1	13	06.9
	27	80	03	49.6	4	14	57.8		11	125	08	23.0	1	08	32.8
	28	80	51	24.3	4	12	32.8		12	126	14	43.7	1	03	59.9
	29	81	39	44.4	4	09	59.7		13	127	21	17.0	0	59	28.4
	30	82	28	48.6	4	07	18.8		14	128	28	02.3	0	54	58.5
	31	83	18	35.4	-4	04	30.4		15	129	34	59.5	-0	50	30.2
Aug.	1	84	09	03.2	4	01	34.9		16	130	42	08.2	0	46	03.8
	2	85	00	10.9	3	58	32.5		17	131	49	28.1	0	41	39.2
	3	85	51	57.0	3	55	23.6		18	132	56	58.9	0	37	16.8
	4	86	44	20.4	3	52	08.3		19	134	04	40.3	0	32	56.5
	5	87	37	19.9	3	48	47.0		20	135	12	32.2	0	28	38.5
	6	88	30	54.2	-3	45	20.0		21	136	20	34.3	-0	24	23.0
	7	89	25	02.3	3	41	47.5		22	137	28	46.4	0	20	10.0
	8	90	19	43.1	3	38	09.8		23	138	37	08.4	0	15	59.7
	9	91	14	55.5	3	34	27.2		24	139	45	40.1	0	11	52.1
	10	92	10	38.5	3	30	39.8		25	140	54	21.3	0	07	47.3
	11	93	06	51.2	3	26	47.9		26	142	03	11.8	-0	03	45.5
	12	94	03	32.6	-3	22	51.8		27	143	12	11.6	+0	00	13.2
	13	95	00	41.7	3	18	51.8		28	144	21	20.4	0	04	08.7
	14	95	58	17.7	3	14	47.9		29	145	30	38.1	0	08	01.0
	15	96	56	19.6	3	10	40.5		30	146	40	04.7	0	11	49.9
	16	97	54	46.7	-3	06	29.8	Oct.	1	147	49	40.1	+0	15	35.3

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GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Oct.	1	147	49	40.1	+0	15	35.3	Nov.	16	203	08	21.3	+1	46	43.3
	2	148	59	24.0	0	19	17.2		17	204	22	19.3	1	46	44.3
	3	150	09	16.5	0	22	55.4		18	205	36	20.1	1	46	40.4
	4	151	19	17.4	0	26	29.9		19	206	50	23.6	1	46	31.6
	5	152	29	26.5	0	30	00.5		20	208	04	29.8	1	46	17.9
	6	153	39	43.8	0	33	27.2		21	209	18	38.5	1	45	59.6
	7	154	50	09.0	+0	36	49.8		22	210	32	49.6	+1	45	36.5
	8	156	00	42.1	0	40	08.4		23	211	47	03.2	1	45	08.7
	9	157	11	22.9	0	43	22.7		24	213	01	19.1	1	44	36.3
	10	158	22	11.2	0	46	32.8		25	214	15	37.3	1	43	59.4
	11	159	33	06.9	0	49	38.6		26	215	29	57.9	1	43	18.0
	12	160	44	09.6	0	52	39.9		27	216	44	20.8	1	42	32.2
	13	161	55	19.4	+0	55	36.7		28	217	58	45.9	+1	41	42.0
	14	163	06	35.9	0	58	29.0		29	219	13	13.3	1	40	47.4
	15	164	17	59.0	1	01	16.7		30	220	27	42.8	1	39	48.7
	16	165	29	28.5	1	03	59.7	Dec.	1	221	42	14.5	1	38	45.7
	17	166	41	04.2	1	06	37.9		2	222	56	48.3	1	37	38.7
	18	167	52	46.1	1	09	11.4		3	224	11	24.2	1	36	27.6
	19	169	04	33.9	+1	11	40.0		4	225	26	02.0	+1	35	12.5
	20	170	16	27.5	1	14	03.8		5	226	40	41.8	1	33	53.6
	21	171	28	26.8	1	16	22.7		6	227	55	23.5	1	32	30.9
	22	172	40	31.6	1	18	36.6		7	229	10	06.9	1	31	04.4
	23	173	52	41.8	1	20	45.6		8	230	24	52.1	1	29	34.3
	24	175	04	57.3	1	22	49.6		9	231	39	39.0	1	28	00.6
	25	176	17	18.0	+1	24	48.5		10	232	54	27.5	+1	26	23.5
	26	177	29	43.8	1	26	42.4		11	234	09	17.6	1	24	43.0
	27	178	42	14.6	1	28	31.2		12	235	24	09.2	1	22	59.2
	28	179	54	50.5	1	30	14.9		13	236	39	02.2	1	21	12.2
	29	181	07	31.3	1	31	53.4		14	237	53	56.6	1	19	22.1
	30	182	20	17.1	1	33	26.8		15	239	08	52.1	1	17	29.1
	31	183	33	07.6	+1	34	55.1		16	240	23	48.7	+1	15	33.2
Nov.	1	184	46	02.9	1	36	18.2		17	241	38	46.3	1	13	34.4
	2	185	59	03.0	1	37	36.1		18	242	53	44.8	1	11	33.0
	3	187	12	07.6	1	38	48.8		19	244	08	44.0	1	09	29.1
	4	188	25	16.8	1	39	56.3		20	245	23	44.0	1	07	22.6
	5	189	38	30.4	1	40	58.6		21	246	38	44.7	1	05	13.8
	6	190	51	48.4	+1	41	55.7		22	247	53	46.0	+1	03	02.7
	7	192	05	10.6	1	42	47.6		23	249	08	48.1	1	00	49.5
	8	193	18	37.0	1	43	34.3		24	250	23	50.9	0	58	34.2
	9	194	32	07.3	1	44	15.8		25	251	38	54.4	0	56	16.9
	10	195	45	41.5	1	44	52.2		26	252	53	58.5	0	53	57.8
	11	196	59	19.4	1	45	23.4		27	254	09	03.3	0	51	36.9
	12	198	13	01.0	+1	45	49.6		28	255	24	08.7	+0	49	14.4
	13	199	26	46.1	1	46	10.6		29	256	39	14.8	0	46	50.3
	14	200	40	34.6	1	46	26.5		30	257	54	21.6	0	44	24.8
	15	201	54	26.4	1	46	37.4		31	259	09	28.9	0	41	58.0
	16	203	08	21.3	+1	46	43.3		32	260	24	36.8	+0	39	29.9

VENUS, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Jan.	0	21	04	48.44	-18	37	42.3	1.283 533	6.85	6.50	14	28	53
	1	21	09	44.59	18	15	56.2	1.277 918	6.88	6.53	14	29	52
	2	21	14	39.26	17	53	40.4	1.272 273	6.91	6.56	14	30	49
	3	21	19	32.47	17	30	55.7	1.266 598	6.94	6.58	14	31	45
	4	21	24	24.20	17	07	42.9	1.260 892	6.97	6.61	14	32	39
	5	21	29	14.46	16	44	02.7	1.255 157	7.01	6.64	14	33	32
	6	21	34	03.26	-16	19	56.0	1.249 393	7.04	6.68	14	34	23
	7	21	38	50.61	15	55	23.5	1.243 599	7.07	6.71	14	35	13
	8	21	43	36.52	15	30	26.1	1.237 776	7.10	6.74	14	36	02
	9	21	48	20.99	15	05	04.6	1.231 924	7.14	6.77	14	36	49
	10	21	53	04.04	14	39	19.7	1.226 044	7.17	6.80	14	37	34
	11	21	57	45.70	14	13	12.3	1.220 136	7.21	6.84	14	38	19
	12	22	02	25.97	-13	46	43.2	1.214 200	7.24	6.87	14	39	02
	13	22	07	04.88	13	19	53.1	1.208 236	7.28	6.90	14	39	43
	14	22	11	42.44	12	52	42.8	1.202 245	7.31	6.94	14	40	23
	15	22	16	18.70	12	25	13.1	1.196 226	7.35	6.97	14	41	02
	16	22	20	53.66	11	57	24.8	1.190 179	7.39	7.01	14	41	40
	17	22	25	27.37	11	29	18.6	1.184 105	7.43	7.04	14	42	16
	18	22	29	59.85	-11	00	55.3	1.178 002	7.47	7.08	14	42	52
	19	22	34	31.13	10	32	15.6	1.171 871	7.50	7.12	14	43	26
	20	22	39	01.24	10	03	20.3	1.165 712	7.54	7.15	14	43	58
	21	22	43	30.20	9	34	10.2	1.159 524	7.58	7.19	14	44	30
	22	22	47	58.05	9	04	46.1	1.153 307	7.63	7.23	14	45	01
	23	22	52	24.81	8	35	08.7	1.147 061	7.67	7.27	14	45	30
	24	22	56	50.51	-8	05	18.9	1.140 785	7.71	7.31	14	45	59
	25	23	01	15.17	7	35	17.3	1.134 479	7.75	7.35	14	46	26
	26	23	05	38.82	7	05	04.8	1.128 144	7.80	7.39	14	46	53
	27	23	10	01.50	6	34	42.1	1.121 778	7.84	7.43	14	47	18
	28	23	14	23.21	6	04	10.1	1.115 383	7.88	7.48	14	47	43
	29	23	18	44.01	5	33	29.3	1.108 958	7.93	7.52	14	48	07
	30	23	23	03.92	-5	02	40.7	1.102 503	7.98	7.56	14	48	30
	31	23	27	22.96	4	31	44.9	1.096 018	8.02	7.61	14	48	51
Feb.	1	23	31	41.16	4	00	42.8	1.089 504	8.07	7.65	14	49	13
	2	23	35	58.57	3	29	35.0	1.082 960	8.12	7.70	14	49	33
	3	23	40	15.20	2	58	22.3	1.076 387	8.17	7.75	14	49	53
	4	23	44	31.09	2	27	05.5	1.069 784	8.22	7.80	14	50	12
	5	23	48	46.27	-1	55	45.2	1.063 154	8.27	7.84	14	50	30
	6	23	53	00.76	1	24	22.3	1.056 495	8.32	7.89	14	50	47
	7	23	57	14.59	0	52	57.5	1.049 807	8.38	7.94	14	51	04
	8	0	01	27.80	-0	21	31.4	1.043 093	8.43	8.00	14	51	20
	9	0	05	40.41	+0	09	55.2	1.036 351	8.49	8.05	14	51	36
	10	0	09	52.46	0	41	21.5	1.029 582	8.54	8.10	14	51	51
	11	0	14	03.96	+1	12	46.9	1.022 788	8.60	8.15	14	52	06
	12	0	18	14.97	1	44	10.7	1.015 967	8.66	8.21	14	52	20
	13	0	22	25.51	2	15	32.3	1.009 120	8.71	8.26	14	52	34
	14	0	26	35.62	2	46	51.0	1.002 248	8.77	8.32	14	52	47
	15	0	30	45.32	+3	18	06.1	0.995 350	8.84	8.38	14	53	00

VENUS, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Feb.	15	0	30	45.32	+3	18	06.1	0.995 350	8.84	8.38	14	53	00
	16	0	34	54.66	3	49	16.9	0.988 426	8.90	8.44	14	53	13
	17	0	39	03.64	4	20	22.9	0.981 477	8.96	8.50	14	53	25
	18	0	43	12.31	4	51	23.4	0.974 501	9.02	8.56	14	53	37
	19	0	47	20.69	5	22	17.6	0.967 500	9.09	8.62	14	53	48
	20	0	51	28.78	5	53	04.9	0.960 473	9.16	8.68	14	53	60
	21	0	55	36.63	+6	23	44.7	0.953 419	9.22	8.75	14	54	11
	22	0	59	44.23	6	54	16.2	0.946 340	9.29	8.81	14	54	22
	23	1	03	51.61	7	24	38.7	0.939 234	9.36	8.88	14	54	33
	24	1	07	58.79	7	54	51.7	0.932 102	9.43	8.95	14	54	43
	25	1	12	05.77	8	24	54.4	0.924 945	9.51	9.02	14	54	53
	26	1	16	12.58	8	54	46.2	0.917 762	9.58	9.09	14	55	04
	27	1	20	19.21	+9	24	26.4	0.910 553	9.66	9.16	14	55	14
	28	1	24	25.69	9	53	54.3	0.903 318	9.74	9.23	14	55	23
	29	1	28	32.02	10	23	09.3	0.896 059	9.81	9.31	14	55	33
Mar.	1	1	32	38.20	10	52	10.7	0.888 775	9.89	9.38	14	55	43
	2	1	36	44.23	11	20	57.9	0.881 466	9.98	9.46	14	55	52
	3	1	40	50.12	11	49	30.2	0.874 134	10.06	9.54	14	56	01
	4	1	44	55.87	+12	17	46.9	0.866 778	10.15	9.62	14	56	10
	5	1	49	01.46	12	45	47.5	0.859 400	10.23	9.70	14	56	19
	6	1	53	06.90	13	13	31.2	0.851 999	10.32	9.79	14	56	28
	7	1	57	12.17	13	40	57.5	0.844 577	10.41	9.87	14	56	37
	8	2	01	17.26	14	08	05.6	0.837 134	10.51	9.96	14	56	45
	9	2	05	22.17	14	34	55.0	0.829 672	10.60	10.05	14	56	53
	10	2	09	26.88	+15	01	25.2	0.822 190	10.70	10.14	14	57	01
	11	2	13	31.39	15	27	35.4	0.814 690	10.79	10.24	14	57	09
	12	2	17	35.68	15	53	25.2	0.807 173	10.89	10.33	14	57	17
	13	2	21	39.75	16	18	54.0	0.799 639	11.00	10.43	14	57	24
	14	2	25	43.57	16	44	01.4	0.792 089	11.10	10.53	14	57	31
	15	2	29	47.12	17	08	46.8	0.784 523	11.21	10.63	14	57	38
	16	2	33	50.39	+17	33	09.7	0.776 942	11.32	10.73	14	57	45
	17	2	37	53.33	17	57	09.6	0.769 346	11.43	10.84	14	57	51
	18	2	41	55.92	18	20	46.0	0.761 736	11.54	10.95	14	57	57
	19	2	45	58.12	18	43	58.5	0.754 111	11.66	11.06	14	58	02
	20	2	49	59.87	19	06	46.4	0.746 474	11.78	11.17	14	58	07
	21	2	54	01.15	19	29	09.4	0.738 823	11.90	11.29	14	58	11
	22	2	58	01.89	+19	51	07.0	0.731 160	12.03	11.41	14	58	15
	23	3	02	02.04	20	12	38.7	0.723 485	12.16	11.53	14	58	18
	24	3	06	01.54	20	33	44.0	0.715 798	12.29	11.65	14	58	21
	25	3	10	00.33	20	54	22.6	0.708 101	12.42	11.78	14	58	23
	26	3	13	58.33	21	14	34.0	0.700 395	12.56	11.91	14	58	23
	27	3	17	55.47	21	34	17.8	0.692 679	12.70	12.04	14	58	23
	28	3	21	51.67	+21	53	33.7	0.684 955	12.84	12.18	14	58	22
	29	3	25	46.85	22	12	21.2	0.677 224	12.99	12.31	14	58	20
	30	3	29	40.91	22	30	40.1	0.669 487	13.14	12.46	14	58	17
	31	3	33	33.75	22	48	29.9	0.661 745	13.29	12.60	14	58	13
Apr.	1	3	37	25.27	+23	05	50.4	0.653 999	13.45	12.75	14	58	07

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RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Apr.	1	3	37	25.27	+23	05	50.4	0.653 999	13.45	12.75	14	58	07
	2	3	41	15.36	23	22	41.2	0.646 251	13.61	12.91	14	57	59
	3	3	45	03.91	23	39	02.0	0.638 502	13.77	13.06	14	57	50
	4	3	48	50.79	23	54	52.6	0.630 754	13.94	13.22	14	57	39
	5	3	52	35.88	24	10	12.7	0.623 008	14.12	13.39	14	57	27
	6	3	56	19.04	24	25	02.2	0.615 266	14.29	13.56	14	57	12
	7	4	00	00.16	+24	39	20.6	0.607 530	14.48	13.73	14	56	55
	8	4	03	39.10	24	53	08.1	0.599 802	14.66	13.90	14	56	36
	9	4	07	15.72	25	06	24.3	0.592 084	14.85	14.09	14	56	15
	10	4	10	49.87	25	19	09.3	0.584 378	15.05	14.27	14	55	51
	11	4	14	21.43	25	31	22.9	0.576 686	15.25	14.46	14	55	24
	12	4	17	50.23	25	43	05.2	0.569 010	15.46	14.66	14	54	55
	13	4	21	16.10	+25	54	16.2	0.561 351	15.67	14.86	14	54	22
	14	4	24	38.89	26	04	55.7	0.553 713	15.88	15.06	14	53	46
	15	4	27	58.42	26	15	03.9	0.546 096	16.10	15.27	14	53	07
	16	4	31	14.51	26	24	40.7	0.538 503	16.33	15.49	14	52	25
	17	4	34	26.96	26	33	46.2	0.530 936	16.56	15.71	14	51	38
	18	4	37	35.57	26	42	20.4	0.523 397	16.80	15.93	14	50	48
	19	4	40	40.15	+26	50	23.3	0.515 889	17.05	16.17	14	49	53
	20	4	43	40.47	26	57	55.1	0.508 413	17.30	16.40	14	48	54
	21	4	46	36.31	27	04	55.7	0.500 974	17.55	16.65	14	47	51
	22	4	49	27.46	27	11	25.2	0.493 573	17.82	16.90	14	46	42
	23	4	52	13.65	27	17	23.6	0.486 213	18.09	17.15	14	45	29
	24	4	54	54.66	27	22	51.1	0.478 898	18.36	17.41	14	44	10
	25	4	57	30.22	+27	27	47.7	0.471 630	18.65	17.68	14	42	46
	26	5	00	00.07	27	32	13.3	0.464 414	18.94	17.96	14	41	16
	27	5	02	23.93	27	36	08.1	0.457 254	19.23	18.24	14	39	39
	28	5	04	41.53	27	39	32.0	0.450 152	19.54	18.53	14	37	56
	29	5	06	52.58	27	42	24.9	0.443 114	19.85	18.82	14	36	07
	30	5	08	56.79	27	44	46.8	0.436 144	20.16	19.12	14	34	10
May	1	5	10	53.85	+27	46	37.6	0.429 247	20.49	19.43	14	32	07
	2	5	12	43.47	27	47	57.1	0.422 428	20.82	19.74	14	29	55
	3	5	14	25.35	27	48	45.1	0.415 693	21.16	20.06	14	27	36
	4	5	15	59.19	27	49	01.2	0.409 047	21.50	20.39	14	25	08
	5	5	17	24.69	27	48	45.3	0.402 496	21.85	20.72	14	22	33
	6	5	18	41.58	27	47	57.0	0.396 048	22.20	21.06	14	19	48
	7	5	19	49.57	+27	46	35.8	0.389 709	22.57	21.40	14	16	54
	8	5	20	48.41	27	44	41.3	0.383 485	22.93	21.75	14	13	51
	9	5	21	37.85	27	42	12.9	0.377 385	23.30	22.10	14	10	39
	10	5	22	17.64	27	39	10.2	0.371 414	23.68	22.45	14	07	17
	11	5	22	47.56	27	35	32.4	0.365 581	24.06	22.81	14	03	45
	12	5	23	07.43	27	31	18.9	0.359 893	24.44	23.17	14	00	03
	13	5	23	17.06	+27	26	28.7	0.354 358	24.82	23.54	13	56	11
	14	5	23	16.31	27	21	01.1	0.348 985	25.20	23.90	13	52	08
	15	5	23	05.07	27	14	55.3	0.343 781	25.58	24.26	13	47	55
	16	5	22	43.26	27	08	10.1	0.338 755	25.96	24.62	13	43	31
	17	5	22	10.85	+27	00	44.9	0.333 915	26.34	24.98	13	38	57

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RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
May	17	5	22	10.85	+27	00	44.9	0.333 915	26.34	24.98	13	38	57
	18	5	21	27.86	26	52	38.5	0.329 271	26.71	25.33	13	34	12
	19	5	20	34.36	26	43	50.2	0.324 832	27.07	25.67	13	29	17
	20	5	19	30.48	26	34	19.2	0.320 606	27.43	26.01	13	24	12
	21	5	18	16.42	26	24	04.9	0.316 603	27.78	26.34	13	18	57
	22	5	16	52.45	26	13	06.6	0.312 832	28.11	26.66	13	13	33
	23	5	15	18.90	+26	01	24.2	0.309 301	28.43	26.96	13	07	59
	24	5	13	36.18	25	48	57.7	0.306 020	28.74	27.25	13	02	16
	25	5	11	44.79	25	35	47.2	0.302 998	29.02	27.52	12	56	25
	26	5	09	45.28	25	21	53.5	0.300 243	29.29	27.78	12	50	27
	27	5	07	38.32	25	07	17.5	0.297 762	29.53	28.01	12	44	21
	28	5	05	24.62	24	52	00.7	0.295 564	29.75	28.22	12	38	09
	29	5	03	04.97	+24	36	05.2	0.293 656	29.95	28.40	12	31	52
	30	5	00	40.24	24	19	33.2	0.292 044	30.11	28.56	12	25	30
	31	4	58	11.35	24	02	27.9	0.290 733	30.25	28.69	12	19	04
June	1	4	55	39.28	23	44	52.8	0.289 729	30.35	28.79	12	12	36
	2	4	53	05.05	23	26	51.8	0.289 035	30.43	28.85	12	06	06
	3	4	50	29.69	23	08	29.5	0.288 655	30.47	28.89	11	59	36
	4	4	47	54.27	+22	49	50.8	0.288 589	30.47	28.90	11	53	06
	5	4	45	19.83	22	31	01.0	0.288 839	30.45	28.87	11	46	38
	6	4	42	47.42	22	12	05.7	0.289 403	30.39	28.82	11	40	12
	7	4	40	18.01	21	53	10.6	0.290 280	30.30	28.73	11	33	50
	8	4	37	52.58	21	34	21.4	0.291 466	30.17	28.61	11	27	31
	9	4	35	32.00	21	15	43.9	0.292 958	30.02	28.47	11	21	19
	10	4	33	17.10	+20	57	23.7	0.294 749	29.84	28.30	11	15	12
	11	4	31	08.63	20	39	26.1	0.296 835	29.63	28.10	11	09	11
	12	4	29	07.26	20	21	56.2	0.299 208	29.39	27.87	11	03	18
	13	4	27	13.57	20	04	58.6	0.301 861	29.13	27.63	10	57	33
	14	4	25	28.06	19	48	37.7	0.304 785	28.85	27.36	10	51	56
	15	4	23	51.17	19	32	57.2	0.307 971	28.56	27.08	10	46	28
	16	4	22	23.23	+19	18	00.3	0.311 412	28.24	26.78	10	41	09
	17	4	21	04.53	19	03	50.1	0.315 098	27.91	26.47	10	35	59
	18	4	19	55.25	18	50	28.6	0.319 019	27.57	26.14	10	30	58
	19	4	18	55.54	18	37	57.9	0.323 166	27.21	25.81	10	26	07
	20	4	18	05.47	18	26	19.1	0.327 530	26.85	25.46	10	21	26
	21	4	17	25.07	18	15	33.3	0.332 101	26.48	25.11	10	16	54
	22	4	16	54.30	+18	05	40.8	0.336 869	26.11	24.76	10	12	31
	23	4	16	33.10	17	56	41.7	0.341 827	25.73	24.40	10	08	18
	24	4	16	21.38	17	48	35.9	0.346 965	25.35	24.04	10	04	15
	25	4	16	19.00	17	41	22.7	0.352 275	24.96	23.67	10	00	20
	26	4	16	25.82	17	35	01.3	0.357 748	24.58	23.31	9	56	35
	27	4	16	41.68	17	29	30.6	0.363 377	24.20	22.95	9	52	58
	28	4	17	06.38	+17	24	49.3	0.369 153	23.82	22.59	9	49	31
	29	4	17	39.74	17	20	56.1	0.375 070	23.45	22.24	9	46	11
	30	4	18	21.57	17	17	49.4	0.381 121	23.07	21.88	9	43	00
July	1	4	19	11.66	17	15	27.5	0.387 298	22.71	21.53	9	39	58
	2	4	20	09.81	+17	13	48.7	0.393 594	22.34	21.19	9	37	03

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RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
July	1	4	19	11.66	+17	15	27.5	0.387 298	22.71	21.53	9	39	58
	2	4	20	09.81	17	13	48.7	0.393 594	22.34	21.19	9	37	03
	3	4	21	15.81	17	12	51.0	0.400 004	21.99	20.85	9	34	16
	4	4	22	29.43	17	12	32.6	0.406 520	21.63	20.52	9	31	36
	5	4	23	50.47	17	12	51.5	0.413 137	21.29	20.19	9	29	03
	6	4	25	18.71	17	13	45.6	0.419 849	20.95	19.86	9	26	38
	7	4	26	53.94	+17	15	12.9	0.426 650	20.61	19.55	9	24	20
	8	4	28	35.93	17	17	11.2	0.433 534	20.28	19.24	9	22	08
	9	4	30	24.48	17	19	38.6	0.440 496	19.96	18.93	9	20	03
	10	4	32	19.37	17	22	32.9	0.447 531	19.65	18.64	9	18	04
	11	4	34	20.41	17	25	52.1	0.454 634	19.34	18.34	9	16	11
	12	4	36	27.40	17	29	34.1	0.461 801	19.04	18.06	9	14	23
	13	4	38	40.13	+17	33	36.9	0.469 027	18.75	17.78	9	12	42
	14	4	40	58.43	17	37	58.5	0.476 309	18.46	17.51	9	11	06
	15	4	43	22.10	17	42	37.1	0.483 642	18.18	17.24	9	09	35
	16	4	45	50.97	17	47	30.7	0.491 022	17.91	16.98	9	08	09
	17	4	48	24.86	17	52	37.5	0.498 448	17.64	16.73	9	06	49
	18	4	51	03.62	17	57	55.7	0.505 914	17.38	16.49	9	05	33
	19	4	53	47.06	+18	03	23.5	0.513 418	17.13	16.24	9	04	21
	20	4	56	35.05	18	08	59.2	0.520 958	16.88	16.01	9	03	14
	21	4	59	27.42	18	14	41.2	0.528 531	16.64	15.78	9	02	12
	22	5	02	24.02	18	20	27.7	0.536 134	16.40	15.56	9	01	14
	23	5	05	24.73	18	26	17.3	0.543 765	16.17	15.34	9	00	19
	24	5	08	29.40	18	32	08.5	0.551 422	15.95	15.12	8	59	29
	25	5	11	37.92	+18	37	59.6	0.559 104	15.73	14.92	8	58	42
	26	5	14	50.16	18	43	49.4	0.566 808	15.52	14.71	8	57	59
	27	5	18	06.03	18	49	36.4	0.574 533	15.31	14.52	8	57	20
	28	5	21	25.41	18	55	19.4	0.582 277	15.10	14.32	8	56	44
	29	5	24	48.21	19	00	57.0	0.590 039	14.90	14.13	8	56	12
	30	5	28	14.32	19	06	28.1	0.597 817	14.71	13.95	8	55	42
	31	5	31	43.66	+19	11	51.4	0.605 609	14.52	13.77	8	55	16
Aug.	1	5	35	16.13	19	17	05.7	0.613 414	14.34	13.60	8	54	53
	2	5	38	51.64	19	22	09.8	0.621 230	14.16	13.42	8	54	33
	3	5	42	30.10	19	27	02.8	0.629 056	13.98	13.26	8	54	16
	4	5	46	11.43	19	31	43.3	0.636 890	13.81	13.09	8	54	02
	5	5	49	55.53	19	36	10.5	0.644 730	13.64	12.94	8	53	51
	6	5	53	42.33	+19	40	23.2	0.652 575	13.48	12.78	8	53	42
	7	5	57	31.73	19	44	20.4	0.660 423	13.32	12.63	8	53	36
	8	6	01	23.66	19	48	01.3	0.668 273	13.16	12.48	8	53	32
	9	6	05	18.03	19	51	24.7	0.676 124	13.01	12.34	8	53	31
	10	6	09	14.76	19	54	29.9	0.683 973	12.86	12.19	8	53	32
	11	6	13	13.76	19	57	15.9	0.691 821	12.71	12.06	8	53	35
	12	6	17	14.97	+19	59	42.0	0.699 664	12.57	11.92	8	53	41
	13	6	21	18.28	20	01	47.4	0.707 504	12.43	11.79	8	53	48
	14	6	25	23.64	20	03	31.2	0.715 337	12.29	11.66	8	53	58
	15	6	29	30.94	20	04	52.8	0.723 164	12.16	11.53	8	54	09
	16	6	33	40.12	+20	05	51.5	0.730 983	12.03	11.41	8	54	22

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RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Aug.	16	6	33	40.12	+20	05	51.5	0.730 983	12.03	11.41	8	54	22
	17	6	37	51.09	20	06	26.7	0.738 794	11.90	11.29	8	54	37
	18	6	42	03.77	20	06	37.6	0.746 595	11.78	11.17	8	54	54
	19	6	46	18.08	20	06	23.7	0.754 385	11.66	11.06	8	55	13
	20	6	50	33.94	20	05	44.5	0.762 166	11.54	10.94	8	55	32
	21	6	54	51.29	20	04	39.4	0.769 934	11.42	10.83	8	55	54
	22	6	59	10.05	+20	03	07.9	0.777 692	11.31	10.72	8	56	16
	23	7	03	30.15	20	01	09.6	0.785 437	11.20	10.62	8	56	41
	24	7	07	51.53	19	58	44.1	0.793 170	11.09	10.51	8	57	06
	25	7	12	14.13	19	55	50.9	0.800 891	10.98	10.41	8	57	32
	26	7	16	37.88	19	52	29.8	0.808 598	10.88	10.31	8	57	60
	27	7	21	02.73	19	48	40.3	0.816 293	10.77	10.22	8	58	29
	28	7	25	28.62	+19	44	22.3	0.823 974	10.67	10.12	8	58	58
	29	7	29	55.48	19	39	35.4	0.831 640	10.57	10.03	8	59	29
	30	7	34	23.27	19	34	19.4	0.839 292	10.48	9.94	9	00	01
	31	7	38	51.91	19	28	34.0	0.846 928	10.38	9.85	9	00	33
Sept.	1	7	43	21.37	19	22	19.1	0.854 548	10.29	9.76	9	01	06
	2	7	47	51.57	19	15	34.5	0.862 152	10.20	9.67	9	01	40
	3	7	52	22.47	+19	08	19.9	0.869 738	10.11	9.59	9	02	15
	4	7	56	54.02	19	00	35.4	0.877 307	10.02	9.51	9	02	50
	5	8	01	26.16	18	52	20.7	0.884 856	9.94	9.43	9	03	26
	6	8	05	58.85	18	43	35.9	0.892 386	9.85	9.35	9	04	02
	7	8	10	32.02	18	34	21.0	0.899 896	9.77	9.27	9	04	39
	8	8	15	05.63	18	24	35.8	0.907 386	9.69	9.19	9	05	16
	9	8	19	39.64	+18	14	20.5	0.914 853	9.61	9.12	9	05	54
	10	8	24	13.99	18	03	35.2	0.922 299	9.54	9.04	9	06	32
	11	8	28	48.63	17	52	19.8	0.929 722	9.46	8.97	9	07	10
	12	8	33	23.52	17	40	34.6	0.937 121	9.38	8.90	9	07	48
	13	8	37	58.61	17	28	19.7	0.944 497	9.31	8.83	9	08	27
	14	8	42	33.85	17	15	35.2	0.951 848	9.24	8.76	9	09	06
	15	8	47	09.20	+17	02	21.4	0.959 174	9.17	8.69	9	09	45
	16	8	51	44.62	16	48	38.5	0.966 475	9.10	8.63	9	10	23
	17	8	56	20.06	16	34	26.7	0.973 750	9.03	8.56	9	11	02
	18	9	00	55.50	16	19	46.3	0.980 999	8.96	8.50	9	11	41
	19	9	05	30.89	16	04	37.5	0.988 222	8.90	8.44	9	12	20
	20	9	10	06.22	15	49	00.8	0.995 419	8.83	8.38	9	12	59
	21	9	14	41.44	+15	32	56.4	1.002 590	8.77	8.32	9	13	37
	22	9	19	16.54	15	16	24.7	1.009 736	8.71	8.26	9	14	16
	23	9	23	51.50	14	59	26.0	1.016 855	8.65	8.20	9	14	54
	24	9	28	26.29	14	42	00.8	1.023 948	8.59	8.14	9	15	33
	25	9	33	00.89	14	24	09.4	1.031 016	8.53	8.09	9	16	11
	26	9	37	35.30	14	05	52.3	1.038 057	8.47	8.03	9	16	48
	27	9	42	09.50	+13	47	09.8	1.045 072	8.41	7.98	9	17	26
	28	9	46	43.48	13	28	02.3	1.052 060	8.36	7.93	9	18	03
	29	9	51	17.22	13	08	30.4	1.059 021	8.30	7.88	9	18	40
	30	9	55	50.73	12	48	34.4	1.065 955	8.25	7.82	9	19	17
Oct.	1	10	00	23.99	+12	28	14.9	1.072 861	8.20	7.77	9	19	54

VENUS, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Oct.	1	10	00	23.99	+12	28	14.9	1.072 861	8.20	7.77	9	19	54
	2	10	04	57.00	12	07	32.2	1.079 740	8.14	7.72	9	20	30
	3	10	09	29.77	11	46	26.9	1.086 590	8.09	7.68	9	21	06
	4	10	14	02.29	11	24	59.5	1.093 411	8.04	7.63	9	21	42
	5	10	18	34.56	11	03	10.5	1.100 202	7.99	7.58	9	22	18
	6	10	23	06.59	10	41	00.4	1.106 964	7.94	7.53	9	22	53
	7	10	27	38.37	+10	18	29.8	1.113 696	7.90	7.49	9	23	28
	8	10	32	09.91	9	55	39.2	1.120 397	7.85	7.44	9	24	03
	9	10	36	41.21	9	32	29.3	1.127 066	7.80	7.40	9	24	38
	10	10	41	12.28	9	09	00.5	1.133 704	7.76	7.36	9	25	12
	11	10	45	43.12	8	45	13.6	1.140 309	7.71	7.31	9	25	47
	12	10	50	13.74	8	21	09.0	1.146 882	7.67	7.27	9	26	21
	13	10	54	44.15	+7	56	47.5	1.153 422	7.62	7.23	9	26	54
	14	10	59	14.35	7	32	09.6	1.159 929	7.58	7.19	9	27	28
	15	11	03	44.36	7	07	16.1	1.166 401	7.54	7.15	9	28	01
	16	11	08	14.19	6	42	07.4	1.172 839	7.50	7.11	9	28	35
	17	11	12	43.85	6	16	44.4	1.179 244	7.46	7.07	9	29	08
	18	11	17	13.36	5	51	07.6	1.185 614	7.42	7.03	9	29	41
	19	11	21	42.74	+5	25	17.7	1.191 950	7.38	7.00	9	30	13
	20	11	26	12.00	4	59	15.4	1.198 252	7.34	6.96	9	30	46
	21	11	30	41.17	4	33	01.4	1.204 520	7.30	6.92	9	31	19
	22	11	35	10.27	4	06	36.3	1.210 755	7.26	6.89	9	31	51
	23	11	39	39.31	3	40	00.8	1.216 956	7.23	6.85	9	32	24
	24	11	44	08.33	3	13	15.6	1.223 123	7.19	6.82	9	32	56
	25	11	48	37.35	+2	46	21.4	1.229 258	7.15	6.78	9	33	29
	26	11	53	06.39	2	19	18.8	1.235 358	7.12	6.75	9	34	01
	27	11	57	35.49	1	52	08.5	1.241 426	7.08	6.72	9	34	34
	28	12	02	04.68	1	24	51.1	1.247 459	7.05	6.69	9	35	06
	29	12	06	33.99	0	57	27.4	1.253 459	7.02	6.65	9	35	39
	30	12	11	03.44	0	29	58.0	1.259 424	6.98	6.62	9	36	12
	31	12	15	33.08	+0	02	23.6	1.265 356	6.95	6.59	9	36	45
Nov.	1	12	20	02.93	-0	25	15.1	1.271 253	6.92	6.56	9	37	19
	2	12	24	33.03	0	52	57.4	1.277 115	6.89	6.53	9	37	53
	3	12	29	03.41	1	20	42.6	1.282 942	6.85	6.50	9	38	26
	4	12	33	34.09	1	48	30.0	1.288 734	6.82	6.47	9	39	01
	5	12	38	05.12	2	16	18.9	1.294 490	6.79	6.44	9	39	35
	6	12	42	36.51	-2	44	08.6	1.300 210	6.76	6.41	9	40	10
	7	12	47	08.31	3	11	58.3	1.305 894	6.73	6.39	9	40	46
	8	12	51	40.55	3	39	47.2	1.311 540	6.71	6.36	9	41	22
	9	12	56	13.24	4	07	34.7	1.317 150	6.68	6.33	9	41	58
	10	13	00	46.43	4	35	19.9	1.322 722	6.65	6.31	9	42	35
	11	13	05	20.15	5	03	02.1	1.328 256	6.62	6.28	9	43	12
	12	13	09	54.42	-5	30	40.6	1.333 752	6.59	6.25	9	43	50
	13	13	14	29.28	5	58	14.5	1.339 209	6.57	6.23	9	44	29
	14	13	19	04.75	6	25	43.2	1.344 627	6.54	6.20	9	45	08
	15	13	23	40.87	6	53	05.7	1.350 007	6.51	6.18	9	45	48
	16	13	28	17.67	-7	20	21.4	1.355 347	6.49	6.15	9	46	28

VENUS, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Nov.	16	13	28	17.67	-7	20	21.4	1.355 347	6.49	6.15	9	46	28
	17	13	32	55.17	7	47	29.5	1.360 650	6.46	6.13	9	47	10
	18	13	37	33.40	8	14	29.1	1.365 914	6.44	6.11	9	47	52
	19	13	42	12.38	8	41	19.4	1.371 139	6.41	6.08	9	48	34
	20	13	46	52.15	9	07	59.7	1.376 327	6.39	6.06	9	49	18
	21	13	51	32.74	9	34	29.2	1.381 477	6.37	6.04	9	50	02
	22	13	56	14.17	-10	00	47.1	1.386 590	6.34	6.01	9	50	48
	23	14	00	56.47	10	26	52.6	1.391 665	6.32	5.99	9	51	34
	24	14	05	39.68	10	52	44.9	1.396 703	6.30	5.97	9	52	21
	25	14	10	23.81	11	18	23.3	1.401 704	6.27	5.95	9	53	09
	26	14	15	08.91	11	43	47.0	1.406 668	6.25	5.93	9	53	58
	27	14	19	54.99	12	08	55.2	1.411 595	6.23	5.91	9	54	48
	28	14	24	42.09	-12	33	47.1	1.416 485	6.21	5.89	9	55	39
	29	14	29	30.23	12	58	21.9	1.421 338	6.19	5.87	9	56	31
	30	14	34	19.43	13	22	39.0	1.426 153	6.17	5.85	9	57	24
Dec.	1	14	39	09.71	13	46	37.4	1.430 932	6.15	5.83	9	58	18
	2	14	44	01.10	14	10	16.3	1.435 673	6.13	5.81	9	59	13
	3	14	48	53.60	14	33	35.1	1.440 377	6.11	5.79	10	00	10
	4	14	53	47.24	-14	56	33.0	1.445 043	6.09	5.77	10	01	08
	5	14	58	42.04	15	19	09.0	1.449 671	6.07	5.75	10	02	06
	6	15	03	37.99	15	41	22.4	1.454 260	6.05	5.73	10	03	06
	7	15	08	35.12	16	03	12.5	1.458 812	6.03	5.72	10	04	07
	8	15	13	33.43	16	24	38.4	1.463 324	6.01	5.70	10	05	10
	9	15	18	32.92	16	45	39.3	1.467 797	5.99	5.68	10	06	13
	10	15	23	33.61	-17	06	14.5	1.472 231	5.97	5.66	10	07	18
	11	15	28	35.50	17	26	23.1	1.476 625	5.96	5.65	10	08	24
	12	15	33	38.58	17	46	04.4	1.480 980	5.94	5.63	10	09	31
	13	15	38	42.86	18	05	17.6	1.485 294	5.92	5.62	10	10	39
	14	15	43	48.32	18	24	02.1	1.489 569	5.90	5.60	10	11	49
	15	15	48	54.95	18	42	16.9	1.493 803	5.89	5.58	10	12	59
	16	15	54	02.75	-19	00	01.4	1.497 998	5.87	5.57	10	14	11
	17	15	59	11.68	19	17	14.8	1.502 153	5.85	5.55	10	15	24
	18	16	04	21.75	19	33	56.4	1.506 268	5.84	5.54	10	16	38
	19	16	09	32.92	19	50	05.5	1.510 345	5.82	5.52	10	17	53
	20	16	14	45.19	20	05	41.4	1.514 383	5.81	5.51	10	19	09
	21	16	19	58.53	20	20	43.5	1.518 383	5.79	5.49	10	20	27
	22	16	25	12.91	-20	35	11.0	1.522 345	5.78	5.48	10	21	45
	23	16	30	28.33	20	49	03.4	1.526 269	5.76	5.46	10	23	04
	24	16	35	44.75	21	02	20.1	1.530 155	5.75	5.45	10	24	25
	25	16	41	02.14	21	15	00.4	1.534 003	5.73	5.44	10	25	46
	26	16	46	20.47	21	27	03.9	1.537 815	5.72	5.42	10	27	08
	27	16	51	39.70	21	38	29.9	1.541 589	5.70	5.41	10	28	31
	28	16	56	59.82	-21	49	18.0	1.545 326	5.69	5.40	10	29	55
	29	17	02	20.76	21	59	27.6	1.549 026	5.68	5.38	10	31	20
	30	17	07	42.50	22	08	58.3	1.552 689	5.66	5.37	10	32	46
	31	17	13	04.99	22	17	49.7	1.556 315	5.65	5.36	10	34	12
	32	17	18	28.18	-22	26	01.2	1.559 904	5.64	5.35	10	35	39

MARS, 2020

HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Heliocentric Longitude ° ' "	Heliocentric Latitude ° ' "	Radius Vector	Date	Heliocentric Longitude ° ' "	Heliocentric Latitude ° ' "	Radius Vector
Jan. 1	214 08 23.9	+0 29 48.3	1.589 7929	Apr. 2	261 35 24.6	-0 58 36.7	1.474 3177
3	215 05 58.0	0 28 00.6	1.587 5695	4	262 42 23.3	1 00 26.2	1.471 7992
5	216 03 41.8	0 26 12.2	1.585 3231	6	263 49 35.8	1 02 14.7	1.469 2951
7	217 01 35.5	0 24 23.0	1.583 0545	8	264 57 02.1	1 04 02.1	1.466 8063
9	217 59 39.1	0 22 33.0	1.580 7641	10	266 04 42.2	1 05 48.4	1.464 3340
11	218 57 52.9	0 20 42.4	1.578 4526	12	267 12 36.1	1 07 33.5	1.461 8791
13	219 56 17.0	+0 18 51.0	1.576 1207	14	268 20 43.7	-1 09 17.4	1.459 4426
15	220 54 51.4	0 16 59.1	1.573 7688	16	269 29 05.0	1 10 60.0	1.457 0256
17	221 53 36.4	0 15 06.5	1.571 3977	18	270 37 40.0	1 12 41.2	1.454 6290
19	222 52 32.1	0 13 13.2	1.569 0079	20	271 46 28.6	1 14 21.0	1.452 2540
21	223 51 38.6	0 11 19.4	1.566 6001	22	272 55 30.7	1 15 59.3	1.449 9015
23	224 50 56.1	0 09 25.0	1.564 1751	24	274 04 46.3	1 17 36.2	1.447 5725
25	225 50 24.6	+0 07 30.2	1.561 7333	26	275 14 15.3	-1 19 11.4	1.445 2681
27	226 50 04.4	0 05 34.7	1.559 2756	28	276 23 57.7	1 20 45.0	1.442 9894
29	227 49 55.4	0 03 38.9	1.556 8027	30	277 33 53.3	1 22 16.9	1.440 7372
31	228 49 58.0	+0 01 42.6	1.554 3151	May 2	278 44 02.0	1 23 47.0	1.438 5127
Feb. 2	229 50 12.1	-0 00 14.1	1.551 8137	4	279 54 23.9	1 25 15.3	1.436 3168
4	230 50 37.9	0 02 11.2	1.549 2992	6	281 04 58.6	1 26 41.7	1.434 1506
6	231 51 15.5	-0 04 08.6	1.546 7722	8	282 15 46.1	-1 28 06.2	1.432 0150
8	232 52 05.1	0 06 06.3	1.544 2337	10	283 26 46.3	1 29 28.6	1.429 9111
10	233 53 06.7	0 08 04.3	1.541 6842	12	284 37 59.1	1 30 49.0	1.427 8399
12	234 54 20.6	0 10 02.5	1.539 1246	14	285 49 24.3	1 32 07.3	1.425 8023
14	235 55 46.6	0 12 00.9	1.536 5557	16	287 01 01.7	1 33 23.4	1.423 7993
16	236 57 25.1	0 13 59.5	1.533 9783	18	288 12 51.2	1 34 37.3	1.421 8319
18	237 59 16.0	-0 15 58.3	1.531 3931	20	289 24 52.6	-1 35 48.9	1.419 9010
20	239 01 19.6	0 17 57.1	1.528 8010	22	290 37 05.7	1 36 58.2	1.418 0077
22	240 03 35.8	0 19 56.0	1.526 2029	24	291 49 30.4	1 38 05.1	1.416 1527
24	241 06 04.8	0 21 54.8	1.523 5994	26	293 02 06.5	1 39 09.5	1.414 3371
26	242 08 46.8	0 23 53.7	1.520 9916	28	294 14 53.7	1 40 11.4	1.412 5618
28	243 11 41.6	0 25 52.5	1.518 3801	30	295 27 51.9	1 41 10.8	1.410 8276
Mar. 1	244 14 49.5	-0 27 51.1	1.515 7660	June 1	296 41 00.7	-1 42 07.6	1.409 1354
3	245 18 10.6	0 29 49.7	1.513 1501	3	297 54 20.1	1 43 01.7	1.407 4861
5	246 21 44.8	0 31 47.9	1.510 5333	5	299 07 49.7	1 43 53.1	1.405 8806
7	247 25 32.4	0 33 46.0	1.507 9164	7	300 21 29.3	1 44 41.8	1.404 3197
9	248 29 33.3	0 35 43.8	1.505 3004	9	301 35 18.6	1 45 27.8	1.402 8042
11	249 33 47.6	0 37 41.2	1.502 6862	11	302 49 17.5	1 46 10.9	1.401 3348
13	250 38 15.4	-0 39 38.3	1.500 0747	13	304 03 25.6	-1 46 51.0	1.399 9125
15	251 42 56.7	0 41 34.9	1.497 4668	15	305 17 42.6	1 47 28.4	1.398 5378
17	252 47 51.6	0 43 31.0	1.494 8636	17	306 32 08.3	1 48 02.7	1.397 2116
19	253 53 00.1	0 45 26.6	1.492 2658	19	307 46 42.3	1 48 34.1	1.395 9346
21	254 58 22.4	0 47 21.7	1.489 6746	21	309 01 24.4	1 49 02.5	1.394 7075
23	256 03 58.3	0 49 16.1	1.487 0907	23	310 16 14.4	1 49 27.8	1.393 5308
25	257 09 48.0	-0 51 09.8	1.484 5154	25	311 31 11.7	-1 49 50.0	1.392 4053
27	258 15 51.5	0 53 02.8	1.481 9494	27	312 46 16.2	1 50 09.2	1.391 3316
29	259 22 08.7	0 54 54.9	1.479 3938	29	314 01 27.5	1 50 25.2	1.390 3103
31	260 28 39.7	0 56 46.3	1.476 8495	July 1	315 16 45.2	1 50 38.1	1.389 3419
Apr. 2	261 35 24.6	-0 58 36.7	1.474 3177	3	316 32 09.1	-1 50 47.8	1.388 4270

MARS, 2020

HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude ° ' "	Heliocentric Latitude ° ' "	Radius Vector	Date		Heliocentric Longitude ° ' "	Heliocentric Latitude ° ' "	Radius Vector
July	1	315 16 45.2	-1 50 38.1	1.389 3419	Oct.	1	13 11 19.0	-1 06 03.9	1.405 2671
	3	316 32 09.1	1 50 47.8	1.388 4270		3	14 24 49.9	1 04 08.6	1.406 8540
	5	317 47 38.8	1 50 54.3	1.387 5660		5	15 38 10.6	1 02 11.8	1.408 4848
	7	319 03 14.0	1 50 57.6	1.386 7595		7	16 51 21.0	1 00 13.6	1.410 1588
	9	320 18 54.2	1 50 57.7	1.386 0079		9	18 04 20.7	0 58 14.0	1.411 8749
	11	321 34 39.2	1 50 54.5	1.385 3116		11	19 17 09.5	0 56 13.2	1.413 6325
	13	322 50 28.6	-1 50 48.1	1.384 6710		13	20 29 47.3	-0 54 11.1	1.415 4305
	15	324 06 22.0	1 50 38.5	1.384 0865		15	21 42 13.8	0 52 08.0	1.417 2681
	17	325 22 19.0	1 50 25.6	1.383 5584		17	22 54 28.9	0 50 03.7	1.419 1444
	19	326 38 19.3	1 50 09.5	1.383 0870		19	24 06 32.3	0 47 58.5	1.421 0584
	21	327 54 22.5	1 49 50.1	1.382 6725		21	25 18 23.9	0 45 52.3	1.423 0092
	23	329 10 28.2	1 49 27.6	1.382 3153		23	26 30 03.5	0 43 45.4	1.424 9958
	25	330 26 36.0	-1 49 01.7	1.382 0154		25	27 41 31.0	-0 41 37.6	1.427 0173
	27	331 42 45.5	1 48 32.7	1.381 7732		27	28 52 46.2	0 39 29.1	1.429 0727
	29	332 58 56.5	1 48 00.5	1.381 5886		29	30 03 48.9	0 37 20.0	1.431 1611
	31	334 15 08.4	1 47 25.0	1.381 4619		31	31 14 39.1	0 35 10.3	1.433 2813
Aug.	2	335 31 20.9	1 46 46.4	1.381 3930	Nov.	2	32 25 16.6	0 33 00.1	1.435 4326
	4	336 47 33.6	1 46 04.7	1.381 3821		4	33 35 41.2	0 30 49.4	1.437 6137
	6	338 03 46.2	-1 45 19.8	1.381 4290		6	34 45 53.0	-0 28 38.4	1.439 8239
	8	339 19 58.1	1 44 31.9	1.381 5339		8	35 55 51.6	0 26 27.1	1.442 0619
	10	340 36 09.1	1 43 40.8	1.381 6966		10	37 05 37.2	0 24 15.5	1.444 3269
	12	341 52 18.8	1 42 46.7	1.381 9171		12	38 15 09.5	0 22 03.8	1.446 6178
	14	343 08 26.7	1 41 49.6	1.382 1951		14	39 24 28.6	0 19 51.9	1.448 9336
	16	344 24 32.6	1 40 49.6	1.382 5306		16	40 33 34.2	0 17 40.0	1.451 2732
	18	345 40 35.9	-1 39 46.6	1.382 9234		18	41 42 26.5	-0 15 28.0	1.453 6357
	20	346 56 36.4	1 38 40.8	1.383 3732		20	42 51 05.2	0 13 16.2	1.456 0201
	22	348 12 33.6	1 37 32.0	1.383 8797		22	43 59 30.4	0 11 04.4	1.458 4252
	24	349 28 27.2	1 36 20.5	1.384 4428		24	45 07 42.0	0 08 52.8	1.460 8502
	26	350 44 16.9	1 35 06.3	1.385 0619		26	46 15 40.0	0 06 41.5	1.463 2939
	28	352 00 02.2	1 33 49.3	1.385 7369		28	47 23 24.3	0 04 30.4	1.465 7554
	30	353 15 42.8	-1 32 29.7	1.386 4673		30	48 30 55.0	-0 02 19.7	1.468 2337
Sept.	1	354 31 18.3	1 31 07.5	1.387 2527	Dec.	2	49 38 11.9	-0 00 09.3	1.470 7277
	3	355 46 48.4	1 29 42.8	1.388 0927		4	50 45 15.1	+0 02 00.5	1.473 2364
	5	357 02 12.7	1 28 15.5	1.388 9867		6	51 52 04.7	0 04 10.0	1.475 7588
	7	358 17 31.0	1 26 45.9	1.389 9344		8	52 58 40.5	0 06 18.8	1.478 2940
	9	359 32 42.8	1 25 13.8	1.390 9351		10	54 05 02.6	0 08 27.1	1.480 8410
	11	0 47 47.9	-1 23 39.5	1.391 9883		12	55 11 11.0	+0 10 34.8	1.483 3986
	13	2 02 45.9	1 22 02.9	1.393 0934		14	56 17 05.8	0 12 41.8	1.485 9661
	15	3 17 36.5	1 20 24.2	1.394 2498		16	57 22 46.9	0 14 48.1	1.488 5423
	17	4 32 19.4	1 18 43.4	1.395 4569		18	58 28 14.4	0 16 53.6	1.491 1264
	19	5 46 54.2	1 17 00.5	1.396 7140		20	59 33 28.3	0 18 58.3	1.493 7173
	21	7 01 20.8	1 15 15.6	1.398 0204		22	60 38 28.7	0 21 02.2	1.496 3142
	23	8 15 38.7	-1 13 28.8	1.399 3755		24	61 43 15.6	+0 23 05.2	1.498 9160
	25	9 29 47.8	1 11 40.1	1.400 7785		26	62 47 49.0	0 25 07.3	1.501 5218
	27	10 43 47.7	1 09 49.7	1.402 2286		28	63 52 09.1	0 27 08.4	1.504 1307
	29	11 57 38.2	1 07 57.6	1.403 7251		30	64 56 15.8	0 29 08.5	1.506 7418
Oct.	1	13 11 19.0	-1 06 03.9	1.405 2671		32	66 00 09.2	+0 31 07.6	1.509 3541

MARS, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Jan.	0	237	42	42.6	+0	22	17.3	Feb.	15	268	58	52.6	-0	10	51.7
	1	238	23	02.7	0	21	41.7		16	269	40	06.9	0	11	43.9
	2	239	03	23.9	0	21	05.9		17	270	21	22.2	0	12	36.6
	3	239	43	46.3	0	20	29.8		18	271	02	38.7	0	13	29.6
	4	240	24	09.9	0	19	53.3		19	271	43	56.2	0	14	23.1
	5	241	04	34.6	0	19	16.6		20	272	25	14.6	0	15	17.0
	6	241	45	00.5	+0	18	39.5		21	273	06	33.9	-0	16	11.3
	7	242	25	27.6	0	18	02.2		22	273	47	54.1	0	17	06.0
	8	243	05	56.1	0	17	24.5		23	274	29	15.0	0	18	01.1
	9	243	46	25.8	0	16	46.5		24	275	10	36.8	0	18	56.7
	10	244	26	56.8	0	16	08.2		25	275	51	59.3	0	19	52.6
	11	245	07	29.1	0	15	29.6		26	276	33	22.5	0	20	49.0
	12	245	48	02.7	+0	14	50.6		27	277	14	46.5	-0	21	45.8
	13	246	28	37.7	0	14	11.3		28	277	56	11.2	0	22	43.0
	14	247	09	13.9	0	13	31.6		29	278	37	36.6	0	23	40.6
	15	247	49	51.5	0	12	51.6	Mar.	1	279	19	02.8	0	24	38.7
	16	248	30	30.4	0	12	11.2		2	280	00	29.7	0	25	37.1
	17	249	11	10.6	0	11	30.4		3	280	41	57.3	0	26	36.0
	18	249	51	52.3	+0	10	49.3		4	281	23	25.7	-0	27	35.3
	19	250	32	35.2	0	10	07.8		5	282	04	54.9	0	28	35.0
	20	251	13	19.5	0	09	26.0		6	282	46	24.8	0	29	35.2
	21	251	54	05.0	0	08	43.8		7	283	27	55.5	0	30	35.8
	22	252	34	51.8	0	08	01.2		8	284	09	26.9	0	31	36.9
	23	253	15	39.7	0	07	18.3		9	284	50	59.1	0	32	38.4
	24	253	56	28.7	+0	06	35.0		10	285	32	32.1	-0	33	40.4
	25	254	37	18.7	0	05	51.4		11	286	14	06.0	0	34	42.8
	26	255	18	09.8	0	05	07.3		12	286	55	40.7	0	35	45.7
	27	255	59	01.9	0	04	23.0		13	287	37	16.4	0	36	49.0
	28	256	39	55.0	0	03	38.2		14	288	18	52.9	0	37	52.8
	29	257	20	49.0	0	02	53.1		15	289	00	30.2	0	38	57.1
	30	258	01	44.1	+0	02	07.7		16	289	42	08.2	-0	40	01.8
	31	258	42	40.1	0	01	21.9		17	290	23	47.0	0	41	07.0
Feb.	1	259	23	37.2	+0	00	35.7		18	291	05	26.3	0	42	12.6
	2	260	04	35.3	-0	00	10.9		19	291	47	06.1	0	43	18.6
	3	260	45	34.5	0	00	57.8		20	292	28	46.4	0	44	25.1
	4	261	26	34.7	0	01	45.1		21	293	10	27.0	0	45	32.1
	5	262	07	36.1	-0	02	32.8		22	293	52	07.9	-0	46	39.4
	6	262	48	38.6	0	03	20.9		23	294	33	49.1	0	47	47.2
	7	263	29	42.2	0	04	09.3		24	295	15	30.5	0	48	55.4
	8	264	10	46.9	0	04	58.2		25	295	57	12.1	0	50	04.0
	9	264	51	52.8	0	05	47.4		26	296	38	53.9	0	51	13.1
	10	265	32	59.8	0	06	37.1		27	297	20	35.8	0	52	22.5
	11	266	14	07.9	-0	07	27.2		28	298	02	17.8	-0	53	32.4
	12	266	55	17.3	0	08	17.7		29	298	43	59.8	0	54	42.8
	13	267	36	27.8	0	09	08.6		30	299	25	42.0	0	55	53.5
	14	268	17	39.6	0	10	00.0		31	300	07	24.2	0	57	04.7
	15	268	58	52.6	-0	10	51.7	Apr.	1	300	49	06.4	-0	58	16.2

MARS, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Apr.	1	300	49	06.4	-0	58	16.2	May	17	332	36	22.6	-2	00	11.4
	2	301	30	48.6	0	59	28.3		18	333	17	11.3	2	01	39.6
	3	302	12	30.8	1	00	40.7		19	333	57	56.8	2	03	08.1
	4	302	54	13.0	1	01	53.6		20	334	38	39.0	2	04	36.7
	5	303	35	55.1	1	03	06.9		21	335	19	17.6	2	06	05.6
	6	304	17	37.2	1	04	20.6		22	335	59	52.6	2	07	34.6
	7	304	59	19.3	-1	05	34.8		23	336	40	23.8	-2	09	03.8
	8	305	41	01.5	1	06	49.5		24	337	20	51.0	2	10	33.2
	9	306	22	43.8	1	08	04.5		25	338	01	14.2	2	12	02.7
	10	307	04	26.1	1	09	20.0		26	338	41	33.2	2	13	32.4
	11	307	46	08.5	1	10	36.0		27	339	21	47.8	2	15	02.3
	12	308	27	50.8	1	11	52.3		28	340	01	58.0	2	16	32.4
	13	309	09	33.0	-1	13	09.1		29	340	42	03.5	-2	18	02.5
	14	309	51	14.9	1	14	26.3		30	341	22	04.4	2	19	32.9
	15	310	32	56.5	1	15	43.9		31	342	02	00.5	2	21	03.3
	16	311	14	37.5	1	17	01.8	June	1	342	41	51.7	2	22	34.0
	17	311	56	18.0	1	18	20.2		2	343	21	38.2	2	24	04.7
	18	312	37	57.8	1	19	38.9		3	344	01	19.7	2	25	35.5
	19	313	19	36.8	-1	20	58.1		4	344	40	56.2	-2	27	06.5
	20	314	01	15.0	1	22	17.6		5	345	20	27.6	2	28	37.6
	21	314	42	52.3	1	23	37.4		6	345	59	53.7	2	30	08.7
	22	315	24	28.6	1	24	57.6		7	346	39	14.5	2	31	39.9
	23	316	06	03.8	1	26	18.2		8	347	18	29.5	2	33	11.1
	24	316	47	37.9	1	27	39.1		9	347	57	38.7	2	34	42.4
	25	317	29	10.7	-1	29	00.4		10	348	36	41.8	-2	36	13.7
	26	318	10	42.4	1	30	22.0		11	349	15	38.4	2	37	45.1
	27	318	52	12.6	1	31	44.0		12	349	54	28.4	2	39	16.4
	28	319	33	41.5	1	33	06.3		13	350	33	11.6	2	40	47.7
	29	320	15	08.9	1	34	28.9		14	351	11	47.6	2	42	18.9
	30	320	56	34.8	1	35	51.9		15	351	50	16.3	2	43	50.2
May	1	321	37	59.1	-1	37	15.2		16	352	28	37.4	-2	45	21.3
	2	322	19	21.7	1	38	38.9		17	353	06	50.5	2	46	52.5
	3	323	00	42.7	1	40	02.9		18	353	44	55.6	2	48	23.5
	4	323	42	02.1	1	41	27.3		19	354	22	52.2	2	49	54.5
	5	324	23	19.9	1	42	51.9		20	355	00	40.1	2	51	25.3
	6	325	04	36.0	1	44	17.0		21	355	38	19.1	2	52	56.1
	7	325	45	50.4	-1	45	42.3		22	356	15	48.8	-2	54	26.8
	8	326	27	03.3	1	47	08.0		23	356	53	09.0	2	55	57.3
	9	327	08	14.3	1	48	33.9		24	357	30	19.5	2	57	27.8
	10	327	49	23.5	1	50	00.2		25	358	07	19.9	2	58	58.1
	11	328	30	30.7	1	51	26.7		26	358	44	10.0	3	00	28.2
	12	329	11	35.7	1	52	53.5		27	359	20	49.7	3	01	58.2
	13	329	52	38.4	-1	54	20.6		28	359	57	18.8	-3	03	28.1
	14	330	33	38.6	1	55	48.0		29	0	33	37.1	3	04	57.7
	15	331	14	36.1	1	57	15.5		30	1	09	44.4	3	06	27.2
	16	331	55	30.8	1	58	43.3	July	1	1	45	40.5	3	07	56.5
	17	332	36	22.6	-2	00	11.4		2	2	21	25.3	-3	09	25.5

MARS, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
July	1	1	45	40.5	-3	07	56.5	Aug.	16	23	58	17.0	-4	06	22.8
	2	2	21	25.3	3	09	25.5		17	24	16	54.6	4	07	13.8
	3	2	56	58.5	3	10	54.3		18	24	34	54.4	4	08	03.0
	4	3	32	19.7	3	12	22.9		19	24	52	15.6	4	08	50.2
	5	4	07	28.8	3	13	51.1		20	25	08	57.5	4	09	35.3
	6	4	42	25.2	3	15	19.1		21	25	24	59.2	4	10	18.3
	7	5	17	08.7	-3	16	46.7		22	25	40	20.1	-4	10	59.1
	8	5	51	38.7	3	18	14.0		23	25	54	59.7	4	11	37.5
	9	6	25	55.0	3	19	40.9		24	26	08	57.3	4	12	13.5
	10	6	59	57.0	3	21	07.4		25	26	22	12.3	4	12	46.9
	11	7	33	44.5	3	22	33.6		26	26	34	44.1	4	13	17.7
	12	8	07	16.8	3	23	59.3		27	26	46	32.0	4	13	45.6
	13	8	40	33.6	-3	25	24.6		28	26	57	35.3	-4	14	10.6
	14	9	13	34.3	3	26	49.4		29	27	07	53.4	4	14	32.5
	15	9	46	18.7	3	28	13.7		30	27	17	25.5	4	14	51.2
	16	10	18	46.0	3	29	37.6		31	27	26	10.9	4	15	06.7
	17	10	50	55.9	3	31	01.0	Sept.	1	27	34	08.9	4	15	18.6
	18	11	22	47.8	3	32	23.8		2	27	41	18.8	4	15	27.0
	19	11	54	21.2	-3	33	46.1		3	27	47	40.0	-4	15	31.7
	20	12	25	35.6	3	35	07.9		4	27	53	11.6	4	15	32.4
	21	12	56	30.4	3	36	29.0		5	27	57	53.2	4	15	29.2
	22	13	27	05.2	3	37	49.6		6	28	01	44.1	4	15	21.8
	23	13	57	19.4	3	39	09.5		7	28	04	43.7	4	15	10.1
	24	14	27	12.7	3	40	28.8		8	28	06	51.5	4	14	53.9
	25	14	56	44.5	-3	41	47.4		9	28	08	07.0	-4	14	33.1
	26	15	25	54.6	3	43	05.3		10	28	08	29.9	4	14	07.6
	27	15	54	42.4	3	44	22.4		11	28	07	59.8	4	13	37.1
	28	16	23	07.6	3	45	38.7		12	28	06	36.5	4	13	01.6
	29	16	51	09.8	3	46	54.3		13	28	04	19.8	4	12	20.8
	30	17	18	48.4	3	48	09.0		14	28	01	09.7	4	11	34.7
	31	17	46	03.0	-3	49	22.7		15	27	57	06.2	-4	10	43.0
Aug.	1	18	12	53.0	3	50	35.6		16	27	52	09.7	4	09	45.7
	2	18	39	17.8	3	51	47.4		17	27	46	20.5	4	08	42.5
	3	19	05	16.7	3	52	58.2		18	27	39	39.4	4	07	33.3
	4	19	30	49.1	3	54	08.0		19	27	32	07.0	4	06	18.0
	5	19	55	54.3	3	55	16.6		20	27	23	44.5	4	04	56.5
	6	20	20	31.6	-3	56	24.0		21	27	14	32.8	-4	03	28.5
	7	20	44	40.1	3	57	30.2		22	27	04	33.3	4	01	54.1
	8	21	08	19.3	3	58	35.2		23	26	53	47.3	4	00	13.0
	9	21	31	28.3	3	59	38.8		24	26	42	16.1	3	58	25.3
	10	21	54	06.3	4	00	41.1		25	26	30	01.2	3	56	30.7
	11	22	16	12.5	4	01	42.0		26	26	17	04.3	3	54	29.4
	12	22	37	46.0	-4	02	41.3		27	26	03	26.9	-3	52	21.2
	13	22	58	46.1	4	03	39.2		28	25	49	10.8	3	50	06.1
	14	23	19	11.9	4	04	35.4		29	25	34	18.0	3	47	44.2
	15	23	39	02.5	4	05	30.0		30	25	18	50.5	3	45	15.4
	16	23	58	17.0	-4	06	22.8	Oct.	1	25	02	50.3	-3	42	39.9

MARS, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Oct.	1	25	02	50.3	-3	42	39.9	Nov.	16	15	15	34.1	-0	47	20.5
	2	24	46	19.7	3	39	57.6		17	15	17	33.1	0	43	57.1
	3	24	29	21.0	3	37	08.6		18	15	20	19.6	0	40	37.4
	4	24	11	56.6	3	34	13.1		19	15	23	53.1	0	37	21.3
	5	23	54	09.0	3	31	11.3		20	15	28	12.8	0	34	08.9
	6	23	36	00.9	3	28	03.2		21	15	33	18.1	0	31	00.2
	7	23	17	34.9	-3	24	49.0		22	15	39	08.4	-0	27	55.2
	8	22	58	53.9	3	21	29.0		23	15	45	42.8	0	24	53.8
	9	22	40	00.6	3	18	03.4		24	15	53	00.6	0	21	56.1
	10	22	20	57.9	3	14	32.3		25	16	01	01.0	0	19	01.9
	11	22	01	48.9	3	10	56.2		26	16	09	43.2	0	16	11.4
	12	21	42	36.6	3	07	15.1		27	16	19	06.3	0	13	24.4
	13	21	23	24.0	-3	03	29.5		28	16	29	09.5	-0	10	41.0
	14	21	04	14.4	2	59	39.7		29	16	39	52.0	0	08	01.0
	15	20	45	10.7	2	55	45.8		30	16	51	12.9	0	05	24.6
	16	20	26	16.4	2	51	48.4	Dec.	1	17	03	11.5	0	02	51.6
	17	20	07	34.6	2	47	47.7		2	17	15	46.8	-0	00	22.0
	18	19	49	08.4	2	43	44.0		3	17	28	58.0	+0	02	04.2
	19	19	31	01.0	-2	39	37.6		4	17	42	44.5	+0	04	27.1
	20	19	13	15.2	2	35	29.0		5	17	57	05.3	0	06	46.7
	21	18	55	53.8	2	31	18.5		6	18	11	59.7	0	09	03.1
	22	18	38	59.3	2	27	06.3		7	18	27	27.0	0	11	16.3
	23	18	22	34.1	2	22	52.9		8	18	43	26.6	0	13	26.3
	24	18	06	40.4	2	18	38.6		9	18	59	57.7	0	15	33.2
	25	17	51	20.2	-2	14	23.6		10	19	16	59.9	+0	17	37.1
	26	17	36	35.5	2	10	08.4		11	19	34	32.4	0	19	38.1
	27	17	22	27.9	2	05	53.3		12	19	52	34.8	0	21	36.1
	28	17	08	59.1	2	01	38.5		13	20	11	06.4	0	23	31.2
	29	16	56	10.4	1	57	24.3		14	20	30	06.8	0	25	23.6
	30	16	44	03.3	1	53	11.1		15	20	49	35.1	0	27	13.2
	31	16	32	38.9	-1	48	59.1		16	21	09	30.9	+0	29	00.2
Nov.	1	16	21	58.2	1	44	48.6		17	21	29	53.3	0	30	44.6
	2	16	12	02.1	1	40	39.7		18	21	50	41.8	0	32	26.5
	3	16	02	51.5	1	36	32.9		19	22	11	55.5	0	34	05.9
	4	15	54	26.9	1	32	28.2		20	22	33	33.9	0	35	43.0
	5	15	46	49.0	1	28	25.9		21	22	55	36.2	0	37	17.6
	6	15	39	58.2	-1	24	26.1		22	23	18	01.9	+0	38	50.0
	7	15	33	54.9	1	20	29.1		23	23	40	50.2	0	40	20.1
	8	15	28	39.4	1	16	35.0		24	24	04	00.6	0	41	48.1
	9	15	24	12.0	1	12	43.9		25	24	27	32.4	0	43	13.8
	10	15	20	32.8	1	08	56.0		26	24	51	25.1	0	44	37.5
	11	15	17	41.9	1	05	11.4		27	25	15	38.0	0	45	59.1
	12	15	15	39.4	-1	01	30.1		28	25	40	10.5	+0	47	18.6
	13	15	14	25.5	0	57	52.4		29	26	05	02.2	0	48	36.2
	14	15	14	00.0	0	54	18.1		30	26	30	12.4	0	49	51.8
	15	15	14	23.0	0	50	47.5		31	26	55	40.7	0	51	05.5
	16	15	15	34.1	-0	47	20.5		32	27	21	26.5	+0	52	17.3

MARS, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Jan.	0	15	42	08.06	-19	17	07.1	2.191 642	4.01	2.14	9	05	10
	1	15	44	54.20	19	26	41.7	2.184 475	4.03	2.14	9	03	59
	2	15	47	40.75	19	36	07.2	2.177 274	4.04	2.15	9	02	50
	3	15	50	27.69	19	45	23.4	2.170 039	4.05	2.16	9	01	40
	4	15	53	15.03	19	54	30.4	2.162 772	4.07	2.16	9	00	31
	5	15	56	02.77	20	03	27.8	2.155 473	4.08	2.17	8	59	23
	6	15	58	50.91	-20	12	15.8	2.148 143	4.09	2.18	8	58	14
	7	16	01	39.45	20	20	54.1	2.140 783	4.11	2.19	8	57	07
	8	16	04	28.39	20	29	22.8	2.133 393	4.12	2.19	8	55	59
	9	16	07	17.72	20	37	41.6	2.125 973	4.14	2.20	8	54	52
	10	16	10	07.45	20	45	50.5	2.118 525	4.15	2.21	8	53	46
	11	16	12	57.57	20	53	49.5	2.111 049	4.17	2.22	8	52	39
	12	16	15	48.08	-21	01	38.4	2.103 545	4.18	2.22	8	51	33
	13	16	18	38.97	21	09	17.0	2.096 013	4.20	2.23	8	50	28
	14	16	21	30.24	21	16	45.4	2.088 454	4.21	2.24	8	49	23
	15	16	24	21.89	21	24	03.4	2.080 868	4.23	2.25	8	48	18
	16	16	27	13.91	21	31	10.9	2.073 255	4.24	2.26	8	47	14
	17	16	30	06.31	21	38	07.8	2.065 616	4.26	2.27	8	46	10
	18	16	32	59.07	-21	44	54.0	2.057 950	4.27	2.27	8	45	06
	19	16	35	52.20	21	51	29.4	2.050 258	4.29	2.28	8	44	03
	20	16	38	45.67	21	57	54.0	2.042 540	4.31	2.29	8	43	00
	21	16	41	39.49	22	04	07.6	2.034 797	4.32	2.30	8	41	57
	22	16	44	33.65	22	10	10.2	2.027 030	4.34	2.31	8	40	55
	23	16	47	28.14	22	16	01.7	2.019 239	4.36	2.32	8	39	53
	24	16	50	22.94	-22	21	42.0	2.011 425	4.37	2.33	8	38	52
	25	16	53	18.04	22	27	10.9	2.003 589	4.39	2.34	8	37	50
	26	16	56	13.44	22	32	28.5	1.995 731	4.41	2.35	8	36	49
	27	16	59	09.14	22	37	34.6	1.987 853	4.42	2.35	8	35	49
	28	17	02	05.11	22	42	29.1	1.979 955	4.44	2.36	8	34	48
	29	17	05	01.36	22	47	12.0	1.972 038	4.46	2.37	8	33	48
	30	17	07	57.88	-22	51	43.2	1.964 103	4.48	2.38	8	32	48
	31	17	10	54.66	22	56	02.7	1.956 151	4.50	2.39	8	31	49
Feb.	1	17	13	51.70	23	00	10.3	1.948 182	4.51	2.40	8	30	49
	2	17	16	48.98	23	04	06.0	1.940 198	4.53	2.41	8	29	50
	3	17	19	46.51	23	07	49.8	1.932 200	4.55	2.42	8	28	51
	4	17	22	44.27	23	11	21.6	1.924 187	4.57	2.43	8	27	52
	5	17	25	42.27	-23	14	41.4	1.916 161	4.59	2.44	8	26	54
	6	17	28	40.48	23	17	49.1	1.908 122	4.61	2.45	8	25	56
	7	17	31	38.92	23	20	44.8	1.900 072	4.63	2.46	8	24	58
	8	17	34	37.56	23	23	28.3	1.892 010	4.65	2.47	8	23	60
	9	17	37	36.39	23	25	59.6	1.883 938	4.67	2.48	8	23	02
	10	17	40	35.42	23	28	18.7	1.875 854	4.69	2.49	8	22	05
	11	17	43	34.63	-23	30	25.4	1.867 761	4.71	2.51	8	21	08
	12	17	46	34.02	23	32	19.9	1.859 657	4.73	2.52	8	20	11
	13	17	49	33.58	23	34	02.0	1.851 543	4.75	2.53	8	19	14
	14	17	52	33.30	23	35	31.7	1.843 419	4.77	2.54	8	18	17
	15	17	55	33.17	-23	36	49.0	1.835 286	4.79	2.55	8	17	20

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RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Feb.	15	17	55	33.17	-23	36	49.0	1.835 286	4.79	2.55	8	17	20
	16	17	58	33.18	23	37	53.8	1.827 143	4.81	2.56	8	16	24
	17	18	01	33.32	23	38	46.2	1.818 991	4.83	2.57	8	15	28
	18	18	04	33.57	23	39	26.1	1.810 831	4.86	2.58	8	14	31
	19	18	07	33.92	23	39	53.5	1.802 663	4.88	2.60	8	13	35
	20	18	10	34.36	23	40	08.4	1.794 487	4.90	2.61	8	12	39
	21	18	13	34.87	-23	40	10.8	1.786 305	4.92	2.62	8	11	43
	22	18	16	35.44	23	40	00.7	1.778 117	4.95	2.63	8	10	47
	23	18	19	36.06	23	39	38.1	1.769 923	4.97	2.64	8	09	51
	24	18	22	36.71	23	39	02.8	1.761 726	4.99	2.66	8	08	55
	25	18	25	37.39	23	38	15.1	1.753 524	5.02	2.67	8	07	60
	26	18	28	38.08	23	37	14.8	1.745 319	5.04	2.68	8	07	04
	27	18	31	38.77	-23	36	02.0	1.737 112	5.06	2.69	8	06	08
	28	18	34	39.46	23	34	36.6	1.728 904	5.09	2.71	8	05	12
	29	18	37	40.13	23	32	58.8	1.720 695	5.11	2.72	8	04	16
Mar.	1	18	40	40.78	23	31	08.5	1.712 487	5.14	2.73	8	03	20
	2	18	43	41.39	23	29	05.7	1.704 279	5.16	2.75	8	02	25
	3	18	46	41.97	23	26	50.5	1.696 073	5.19	2.76	8	01	29
	4	18	49	42.50	-23	24	23.0	1.687 870	5.21	2.77	8	00	33
	5	18	52	42.96	23	21	43.1	1.679 670	5.24	2.79	7	59	36
	6	18	55	43.36	23	18	51.0	1.671 473	5.26	2.80	7	58	40
	7	18	58	43.69	23	15	46.6	1.663 280	5.29	2.81	7	57	44
	8	19	01	43.93	23	12	29.9	1.655 092	5.31	2.83	7	56	48
	9	19	04	44.07	23	09	01.1	1.646 909	5.34	2.84	7	55	51
	10	19	07	44.13	-23	05	20.1	1.638 731	5.37	2.86	7	54	55
	11	19	10	44.07	23	01	27.0	1.630 558	5.39	2.87	7	53	58
	12	19	13	43.91	22	57	21.9	1.622 390	5.42	2.88	7	53	02
	13	19	16	43.64	22	53	04.7	1.614 228	5.45	2.90	7	52	05
	14	19	19	43.24	22	48	35.5	1.606 071	5.48	2.91	7	51	08
	15	19	22	42.70	22	43	54.5	1.597 920	5.50	2.93	7	50	11
	16	19	25	42.01	-22	39	01.6	1.589 774	5.53	2.94	7	49	13
	17	19	28	41.17	22	33	57.0	1.581 635	5.56	2.96	7	48	16
	18	19	31	40.14	22	28	40.7	1.573 502	5.59	2.97	7	47	18
	19	19	34	38.93	22	23	12.9	1.565 375	5.62	2.99	7	46	21
	20	19	37	37.53	22	17	33.5	1.557 256	5.65	3.01	7	45	23
	21	19	40	35.91	22	11	42.7	1.549 145	5.68	3.02	7	44	24
	22	19	43	34.07	-22	05	40.5	1.541 043	5.71	3.04	7	43	26
	23	19	46	31.99	21	59	27.1	1.532 949	5.74	3.05	7	42	27
	24	19	49	29.68	21	53	02.5	1.524 865	5.77	3.07	7	41	28
	25	19	52	27.13	21	46	26.8	1.516 791	5.80	3.09	7	40	29
	26	19	55	24.31	21	39	40.0	1.508 728	5.83	3.10	7	39	30
	27	19	58	21.24	21	32	42.4	1.500 676	5.86	3.12	7	38	30
	28	20	01	17.90	-21	25	33.9	1.492 637	5.89	3.14	7	37	30
	29	20	04	14.28	21	18	14.8	1.484 610	5.92	3.15	7	36	30
	30	20	07	10.39	21	10	45.1	1.476 597	5.96	3.17	7	35	30
	31	20	10	06.20	21	03	04.9	1.468 598	5.99	3.19	7	34	29
Apr.	1	20	13	01.73	-20	55	14.3	1.460 614	6.02	3.20	7	33	28

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Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Apr.	1	20	13	01.73	-20	55	14.3	1.460 614	6.02	3.20	7	33	28
	2	20	15	56.96	20	47	13.5	1.452 644	6.05	3.22	7	32	26
	3	20	18	51.89	20	39	02.6	1.444 691	6.09	3.24	7	31	25
	4	20	21	46.51	20	30	41.6	1.436 753	6.12	3.26	7	30	23
	5	20	24	40.83	20	22	10.7	1.428 832	6.15	3.28	7	29	20
	6	20	27	34.83	20	13	30.0	1.420 928	6.19	3.29	7	28	18
	7	20	30	28.53	-20	04	39.5	1.413 040	6.22	3.31	7	27	15
	8	20	33	21.91	19	55	39.4	1.405 169	6.26	3.33	7	26	12
	9	20	36	14.98	19	46	29.8	1.397 315	6.29	3.35	7	25	08
	10	20	39	07.74	19	37	10.8	1.389 477	6.33	3.37	7	24	04
	11	20	42	00.18	19	27	42.5	1.381 656	6.36	3.39	7	23	00
	12	20	44	52.30	19	18	05.1	1.373 851	6.40	3.41	7	21	56
	13	20	47	44.09	-19	08	18.7	1.366 062	6.44	3.43	7	20	51
	14	20	50	35.53	18	58	23.5	1.358 290	6.47	3.45	7	19	46
	15	20	53	26.62	18	48	19.6	1.350 535	6.51	3.47	7	18	40
	16	20	56	17.36	18	38	07.1	1.342 796	6.55	3.49	7	17	34
	17	20	59	07.73	18	27	46.2	1.335 074	6.59	3.51	7	16	28
	18	21	01	57.72	18	17	17.1	1.327 369	6.63	3.53	7	15	21
	19	21	04	47.34	-18	06	39.8	1.319 682	6.66	3.55	7	14	14
	20	21	07	36.58	17	55	54.6	1.312 013	6.70	3.57	7	13	07
	21	21	10	25.43	17	45	01.5	1.304 363	6.74	3.59	7	11	59
	22	21	13	13.89	17	34	00.8	1.296 731	6.78	3.61	7	10	51
	23	21	16	01.95	17	22	52.6	1.289 118	6.82	3.63	7	09	43
	24	21	18	49.62	17	11	37.0	1.281 525	6.86	3.65	7	08	34
	25	21	21	36.88	-17	00	14.2	1.273 952	6.90	3.67	7	07	24
	26	21	24	23.74	16	48	44.4	1.266 400	6.94	3.70	7	06	15
	27	21	27	10.20	16	37	07.7	1.258 869	6.99	3.72	7	05	04
	28	21	29	56.24	16	25	24.3	1.251 359	7.03	3.74	7	03	54
	29	21	32	41.88	16	13	34.4	1.243 872	7.07	3.76	7	02	43
	30	21	35	27.11	16	01	38.0	1.236 406	7.11	3.79	7	01	31
May	1	21	38	11.92	-15	49	35.4	1.228 963	7.16	3.81	7	00	20
	2	21	40	56.33	15	37	26.8	1.221 544	7.20	3.83	6	59	07
	3	21	43	40.32	15	25	12.2	1.214 147	7.24	3.85	6	57	55
	4	21	46	23.91	15	12	51.8	1.206 774	7.29	3.88	6	56	42
	5	21	49	07.09	15	00	25.7	1.199 424	7.33	3.90	6	55	28
	6	21	51	49.88	14	47	54.0	1.192 097	7.38	3.93	6	54	15
	7	21	54	32.26	-14	35	17.0	1.184 793	7.42	3.95	6	53	00
	8	21	57	14.26	14	22	34.7	1.177 511	7.47	3.97	6	51	46
	9	21	59	55.85	14	09	47.3	1.170 252	7.51	4.00	6	50	31
	10	22	02	37.05	13	56	55.0	1.163 015	7.56	4.02	6	49	15
	11	22	05	17.85	13	43	58.0	1.155 800	7.61	4.05	6	47	59
	12	22	07	58.23	13	30	56.4	1.148 607	7.66	4.07	6	46	43
	13	22	10	38.20	-13	17	50.5	1.141 435	7.70	4.10	6	45	27
	14	22	13	17.74	13	04	40.4	1.134 284	7.75	4.13	6	44	09
	15	22	15	56.85	12	51	26.3	1.127 155	7.80	4.15	6	42	52
	16	22	18	35.54	12	38	08.4	1.120 048	7.85	4.18	6	41	34
	17	22	21	13.78	-12	24	46.9	1.112 962	7.90	4.20	6	40	16

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RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
May	17	22	21	13.78	-12	24	46.9	1.112 962	7.90	4.20	6	40	16
	18	22	23	51.59	12	11	21.9	1.105 898	7.95	4.23	6	38	57
	19	22	26	28.94	11	57	53.7	1.098 855	8.00	4.26	6	37	38
	20	22	29	05.85	11	44	22.4	1.091 835	8.05	4.29	6	36	18
	21	22	31	42.31	11	30	48.3	1.084 838	8.11	4.31	6	34	58
	22	22	34	18.31	11	17	11.5	1.077 863	8.16	4.34	6	33	37
	23	22	36	53.86	-11	03	32.1	1.070 911	8.21	4.37	6	32	16
	24	22	39	28.94	10	49	50.5	1.063 982	8.27	4.40	6	30	55
	25	22	42	03.55	10	36	06.8	1.057 077	8.32	4.43	6	29	33
	26	22	44	37.70	10	22	21.1	1.050 196	8.37	4.46	6	28	10
	27	22	47	11.37	10	08	33.8	1.043 338	8.43	4.49	6	26	47
	28	22	49	44.57	9	54	44.8	1.036 506	8.48	4.52	6	25	24
	29	22	52	17.30	-9	40	54.5	1.029 698	8.54	4.55	6	23	60
	30	22	54	49.54	9	27	03.0	1.022 914	8.60	4.58	6	22	36
	31	22	57	21.32	9	13	10.4	1.016 156	8.65	4.61	6	21	11
June	1	22	59	52.63	8	59	16.9	1.009 422	8.71	4.64	6	19	46
	2	23	02	23.46	8	45	22.6	1.002 714	8.77	4.67	6	18	20
	3	23	04	53.83	8	31	27.7	0.996 030	8.83	4.70	6	16	54
	4	23	07	23.74	-8	17	32.3	0.989 370	8.89	4.73	6	15	27
	5	23	09	53.17	8	03	36.6	0.982 734	8.95	4.76	6	13	60
	6	23	12	22.15	7	49	40.8	0.976 122	9.01	4.79	6	12	32
	7	23	14	50.64	7	35	45.0	0.969 533	9.07	4.83	6	11	04
	8	23	17	18.65	7	21	49.4	0.962 966	9.13	4.86	6	09	35
	9	23	19	46.17	7	07	54.4	0.956 422	9.19	4.89	6	08	06
	10	23	22	13.19	-6	53	59.9	0.949 900	9.26	4.93	6	06	37
	11	23	24	39.70	6	40	06.3	0.943 400	9.32	4.96	6	05	07
	12	23	27	05.68	6	26	13.8	0.936 922	9.39	5.00	6	03	36
	13	23	29	31.14	6	12	22.5	0.930 465	9.45	5.03	6	02	05
	14	23	31	56.06	5	58	32.7	0.924 030	9.52	5.06	6	00	33
	15	23	34	20.42	5	44	44.6	0.917 617	9.58	5.10	5	59	01
	16	23	36	44.23	-5	30	58.3	0.911 225	9.65	5.14	5	57	28
	17	23	39	07.47	5	17	14.1	0.904 854	9.72	5.17	5	55	55
	18	23	41	30.12	5	03	32.2	0.898 506	9.79	5.21	5	54	21
	19	23	43	52.19	4	49	52.8	0.892 179	9.86	5.25	5	52	46
	20	23	46	13.65	4	36	16.1	0.885 875	9.93	5.28	5	51	11
	21	23	48	34.49	4	22	42.3	0.879 593	10.00	5.32	5	49	35
	22	23	50	54.71	-4	09	11.6	0.873 334	10.07	5.36	5	47	59
	23	23	53	14.30	3	55	44.2	0.867 097	10.14	5.40	5	46	22
	24	23	55	33.23	3	42	20.3	0.860 884	10.22	5.44	5	44	44
	25	23	57	51.50	3	29	00.1	0.854 694	10.29	5.48	5	43	06
	26	0	00	09.10	3	15	43.7	0.848 529	10.36	5.52	5	41	27
	27	0	02	26.02	3	02	31.4	0.842 387	10.44	5.56	5	39	47
	28	0	04	42.26	-2	49	23.3	0.836 269	10.52	5.60	5	38	07
	29	0	06	57.82	2	36	19.4	0.830 175	10.59	5.64	5	36	26
	30	0	09	12.67	2	23	20.0	0.824 105	10.67	5.68	5	34	44
July	1	0	11	26.82	2	10	25.2	0.818 059	10.75	5.72	5	33	02
	2	0	13	40.26	-1	57	35.2	0.812 036	10.83	5.76	5	31	19

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RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
July	1	0	11	26.82	-2	10	25.2	0.818 059	10.75	5.72	5	33	02
	2	0	13	40.26	1	57	35.2	0.812 036	10.83	5.76	5	31	19
	3	0	15	52.98	1	44	50.0	0.806 037	10.91	5.81	5	29	35
	4	0	18	04.96	1	32	09.9	0.800 061	10.99	5.85	5	27	50
	5	0	20	16.18	1	19	35.0	0.794 108	11.07	5.89	5	26	05
	6	0	22	26.63	1	07	05.5	0.788 177	11.16	5.94	5	24	19
	7	0	24	36.28	0	54	41.7	0.782 267	11.24	5.98	5	22	32
	8	0	26	45.11	0	42	23.6	0.776 380	11.33	6.03	5	20	44
	9	0	28	53.11	0	30	11.6	0.770 514	11.41	6.07	5	18	55
	10	0	31	00.25	0	18	05.8	0.764 670	11.50	6.12	5	17	06
	11	0	33	06.50	-0	06	06.5	0.758 847	11.59	6.17	5	15	15
	12	0	35	11.84	+0	05	46.2	0.753 045	11.68	6.21	5	13	24
	13	0	37	16.24	+0	17	32.1	0.747 265	11.77	6.26	5	11	32
	14	0	39	19.68	0	29	11.0	0.741 507	11.86	6.31	5	09	39
	15	0	41	22.13	0	40	42.5	0.735 770	11.95	6.36	5	07	45
	16	0	43	23.56	0	52	06.7	0.730 056	12.05	6.41	5	05	49
	17	0	45	23.94	1	03	23.2	0.724 364	12.14	6.46	5	03	53
	18	0	47	23.25	1	14	31.8	0.718 695	12.24	6.51	5	01	56
	19	0	49	21.44	+1	25	32.4	0.713 049	12.33	6.56	4	59	57
	20	0	51	18.50	1	36	24.7	0.707 427	12.43	6.62	4	57	58
	21	0	53	14.38	1	47	08.5	0.701 829	12.53	6.67	4	55	57
	22	0	55	09.07	1	57	43.7	0.696 256	12.63	6.72	4	53	55
	23	0	57	02.52	2	08	10.1	0.690 708	12.73	6.78	4	51	52
	24	0	58	54.71	2	18	27.5	0.685 186	12.83	6.83	4	49	47
	25	1	00	45.61	+2	28	35.8	0.679 691	12.94	6.89	4	47	42
	26	1	02	35.20	2	38	34.9	0.674 223	13.04	6.94	4	45	35
	27	1	04	23.46	2	48	24.7	0.668 783	13.15	7.00	4	43	26
	28	1	06	10.35	2	58	05.1	0.663 370	13.26	7.05	4	41	17
	29	1	07	55.86	3	07	35.9	0.657 986	13.37	7.11	4	39	05
	30	1	09	39.94	3	16	57.0	0.652 629	13.47	7.17	4	36	53
	31	1	11	22.56	+3	26	08.4	0.647 301	13.59	7.23	4	34	39
Aug.	1	1	13	03.69	3	35	09.8	0.642 002	13.70	7.29	4	32	23
	2	1	14	43.30	3	44	01.1	0.636 731	13.81	7.35	4	30	06
	3	1	16	21.32	3	52	42.2	0.631 489	13.93	7.41	4	27	48
	4	1	17	57.74	4	01	12.9	0.626 276	14.04	7.47	4	25	27
	5	1	19	32.49	4	09	33.0	0.621 092	14.16	7.54	4	23	06
	6	1	21	05.53	+4	17	42.3	0.615 938	14.28	7.60	4	20	42
	7	1	22	36.81	4	25	40.7	0.610 814	14.40	7.66	4	18	17
	8	1	24	06.29	4	33	28.0	0.605 721	14.52	7.73	4	15	50
	9	1	25	33.90	4	41	03.9	0.600 659	14.64	7.79	4	13	21
	10	1	26	59.61	4	48	28.4	0.595 629	14.76	7.86	4	10	50
	11	1	28	23.35	4	55	41.2	0.590 632	14.89	7.92	4	08	17
	12	1	29	45.08	+5	02	42.1	0.585 669	15.02	7.99	4	05	42
	13	1	31	04.72	5	09	31.1	0.580 741	15.14	8.06	4	03	05
	14	1	32	22.24	5	16	07.8	0.575 848	15.27	8.13	4	00	26
	15	1	33	37.56	5	22	32.1	0.570 993	15.40	8.20	3	57	44
	16	1	34	50.64	+5	28	43.8	0.566 175	15.53	8.27	3	55	01

MARS, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Aug.	16	1	34	50.64	+5	28	43.8	0.566 175	15.53	8.27	3	55	01
	17	1	36	01.40	5	34	42.9	0.561 398	15.66	8.34	3	52	15
	18	1	37	09.80	5	40	29.0	0.556 662	15.80	8.41	3	49	27
	19	1	38	15.78	5	46	02.1	0.551 969	15.93	8.48	3	46	36
	20	1	39	19.28	5	51	22.1	0.547 320	16.07	8.55	3	43	43
	21	1	40	20.26	5	56	28.8	0.542 718	16.20	8.62	3	40	47
	22	1	41	18.67	+6	01	22.2	0.538 163	16.34	8.70	3	37	49
	23	1	42	14.46	6	06	02.3	0.533 658	16.48	8.77	3	34	49
	24	1	43	07.60	6	10	28.9	0.529 204	16.62	8.84	3	31	45
	25	1	43	58.03	6	14	42.2	0.524 802	16.76	8.92	3	28	39
	26	1	44	45.72	6	18	42.1	0.520 454	16.90	8.99	3	25	30
	27	1	45	30.61	6	22	28.4	0.516 162	17.04	9.07	3	22	18
	28	1	46	12.66	+6	26	01.3	0.511 926	17.18	9.14	3	19	04
	29	1	46	51.82	6	29	20.5	0.507 749	17.32	9.22	3	15	47
	30	1	47	28.05	6	32	26.2	0.503 631	17.46	9.29	3	12	26
	31	1	48	01.28	6	35	18.1	0.499 575	17.60	9.37	3	09	03
Sept.	1	1	48	31.47	6	37	56.2	0.495 581	17.75	9.44	3	05	37
	2	1	48	58.57	6	40	20.5	0.491 653	17.89	9.52	3	02	08
	3	1	49	22.54	+6	42	30.9	0.487 790	18.03	9.59	2	58	35
	4	1	49	43.32	6	44	27.3	0.483 997	18.17	9.67	2	54	59
	5	1	50	00.88	6	46	09.7	0.480 274	18.31	9.74	2	51	21
	6	1	50	15.16	6	47	38.1	0.476 624	18.45	9.82	2	47	39
	7	1	50	26.13	6	48	52.3	0.473 049	18.59	9.89	2	43	53
	8	1	50	33.75	6	49	52.5	0.469 552	18.73	9.97	2	40	04
	9	1	50	37.99	+6	50	38.5	0.466 135	18.87	10.04	2	36	12
	10	1	50	38.82	6	51	10.5	0.462 801	19.00	10.11	2	32	17
	11	1	50	36.21	6	51	28.4	0.459 553	19.14	10.18	2	28	18
	12	1	50	30.15	6	51	32.3	0.456 393	19.27	10.25	2	24	16
	13	1	50	20.62	6	51	22.2	0.453 325	19.40	10.32	2	20	10
	14	1	50	07.61	6	50	58.4	0.450 352	19.53	10.39	2	16	01
	15	1	49	51.14	+6	50	20.8	0.447 477	19.65	10.46	2	11	48
	16	1	49	31.20	6	49	29.8	0.444 703	19.78	10.52	2	07	32
	17	1	49	07.83	6	48	25.6	0.442 034	19.89	10.59	2	03	13
	18	1	48	41.07	6	47	08.4	0.439 473	20.01	10.65	1	58	50
	19	1	48	10.95	6	45	38.6	0.437 022	20.12	10.71	1	54	24
	20	1	47	37.55	6	43	56.7	0.434 686	20.23	10.77	1	49	55
	21	1	47	00.93	+6	42	03.1	0.432 467	20.33	10.82	1	45	22
	22	1	46	21.17	6	39	58.2	0.430 368	20.43	10.87	1	40	46
	23	1	45	38.34	6	37	42.7	0.428 392	20.53	10.92	1	36	08
	24	1	44	52.54	6	35	16.9	0.426 541	20.62	10.97	1	31	26
	25	1	44	03.85	6	32	41.4	0.424 817	20.70	11.02	1	26	42
	26	1	43	12.38	6	29	56.7	0.423 223	20.78	11.06	1	21	54
	27	1	42	18.23	+6	27	03.3	0.421 762	20.85	11.10	1	17	04
	28	1	41	21.50	6	24	01.9	0.420 435	20.92	11.13	1	12	12
	29	1	40	22.33	6	20	53.1	0.419 246	20.98	11.16	1	07	17
	30	1	39	20.84	6	17	37.4	0.418 196	21.03	11.19	1	02	20
Oct.	1	1	38	17.16	+6	14	15.4	0.417 287	21.07	11.22	0	57	21

MARS, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Oct.	1	1	38	17.16	+6	14	15.4	0.417 287	21.07	11.22	0	57	21
	2	1	37	11.44	6	10	48.0	0.416 522	21.11	11.24	0	52	20
	3	1	36	03.82	6	07	15.6	0.415 903	21.14	11.25	0	47	16
	4	1	34	54.45	6	03	39.2	0.415 433	21.17	11.27	0	42	11
	5	1	33	43.51	5	59	59.3	0.415 112	21.19	11.27	0	37	05
	6	1	32	31.14	5	56	16.8	0.414 943	21.19	11.28	0	31	57
	7	1	31	17.54	+5	52	32.4	0.414 928	21.19	11.28	0	26	48
	8	1	30	02.87	5	48	46.9	0.415 069	21.19	11.28	0	21	38
	9	1	28	47.31	5	45	01.2	0.415 367	21.17	11.27	0	16	27
	10	1	27	31.06	5	41	16.0	0.415 824	21.15	11.25	0	11	15
	11	1	26	14.30	5	37	32.3	0.416 441	21.12	11.24	0	06	03
	12	1	24	57.24	5	33	50.9	0.417 220	21.08	11.22	0	00	51
	13	1	23	40.06	+5	30	12.6	0.418 161	21.03	11.19	23	50	26
	14	1	22	22.96	5	26	38.3	0.419 267	20.98	11.16	23	45	13
	15	1	21	06.17	5	23	09.0	0.420 536	20.91	11.13	23	40	02
	16	1	19	49.87	5	19	45.6	0.421 971	20.84	11.09	23	34	51
	17	1	18	34.27	5	16	29.0	0.423 570	20.76	11.05	23	29	40
	18	1	17	19.59	5	13	20.1	0.425 335	20.68	11.00	23	24	31
	19	1	16	06.02	+5	10	19.8	0.427 264	20.58	10.95	23	19	24
	20	1	14	53.73	5	07	29.0	0.429 357	20.48	10.90	23	14	17
	21	1	13	42.92	5	04	48.3	0.431 613	20.38	10.84	23	09	13
	22	1	12	33.74	5	02	18.6	0.434 029	20.26	10.78	23	04	10
	23	1	11	26.35	5	00	00.5	0.436 606	20.14	10.72	22	59	09
	24	1	10	20.89	4	57	54.6	0.439 342	20.02	10.65	22	54	10
	25	1	09	17.49	+4	56	01.3	0.442 234	19.89	10.58	22	49	13
	26	1	08	16.28	4	54	21.1	0.445 281	19.75	10.51	22	44	18
	27	1	07	17.38	4	52	54.6	0.448 481	19.61	10.44	22	39	26
	28	1	06	20.88	4	51	42.0	0.451 834	19.46	10.36	22	34	36
	29	1	05	26.89	4	50	43.8	0.455 335	19.31	10.28	22	29	49
	30	1	04	35.48	4	50	00.2	0.458 985	19.16	10.20	22	25	05
	31	1	03	46.75	+4	49	31.4	0.462 780	19.00	10.11	22	20	23
Nov.	1	1	03	00.75	4	49	17.7	0.466 720	18.84	10.03	22	15	44
	2	1	02	17.55	4	49	19.2	0.470 801	18.68	9.94	22	11	07
	3	1	01	37.21	4	49	36.1	0.475 023	18.51	9.85	22	06	34
	4	1	00	59.77	4	50	08.5	0.479 382	18.34	9.76	22	02	04
	5	1	00	25.26	4	50	56.5	0.483 878	18.17	9.67	21	57	36
	6	0	59	53.73	+4	52	00.0	0.488 509	18.00	9.58	21	53	12
	7	0	59	25.20	4	53	19.2	0.493 271	17.83	9.49	21	48	50
	8	0	58	59.70	4	54	54.0	0.498 164	17.65	9.39	21	44	32
	9	0	58	37.23	4	56	44.4	0.503 186	17.48	9.30	21	40	16
	10	0	58	17.82	4	58	50.4	0.508 334	17.30	9.21	21	36	04
	11	0	58	01.48	5	01	11.9	0.513 606	17.12	9.11	21	31	54
	12	0	57	48.22	+5	03	48.9	0.519 001	16.94	9.02	21	27	48
	13	0	57	38.04	5	06	41.4	0.524 517	16.77	8.92	21	23	45
	14	0	57	30.94	5	09	49.2	0.530 150	16.59	8.83	21	19	44
	15	0	57	26.92	5	13	12.4	0.535 899	16.41	8.73	21	15	47
	16	0	57	25.98	+5	16	50.9	0.541 761	16.23	8.64	21	11	53

MARS, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Nov.	16	0	57	25.98	+5	16	50.9	0.541 761	16.23	8.64	21	11	53
	17	0	57	28.08	5	20	44.4	0.547 734	16.06	8.54	21	08	02
	18	0	57	33.22	5	24	52.8	0.553 814	15.88	8.45	21	04	14
	19	0	57	41.35	5	29	16.0	0.560 000	15.70	8.36	21	00	28
	20	0	57	52.44	5	33	53.5	0.566 288	15.53	8.26	20	56	46
	21	0	58	06.45	5	38	45.3	0.572 676	15.36	8.17	20	53	06
	22	0	58	23.33	+5	43	50.9	0.579 162	15.18	8.08	20	49	30
	23	0	58	43.05	5	49	10.1	0.585 743	15.01	7.99	20	45	56
	24	0	59	05.55	5	54	42.6	0.592 417	14.84	7.90	20	42	25
	25	0	59	30.78	6	00	28.1	0.599 182	14.68	7.81	20	38	56
	26	0	59	58.71	6	06	26.2	0.606 035	14.51	7.72	20	35	30
	27	1	00	29.27	6	12	36.6	0.612 975	14.35	7.63	20	32	07
	28	1	01	02.42	+6	18	59.1	0.620 001	14.18	7.55	20	28	46
	29	1	01	38.10	6	25	33.2	0.627 109	14.02	7.46	20	25	28
	30	1	02	16.28	6	32	18.7	0.634 298	13.86	7.38	20	22	12
Dec.	1	1	02	56.89	6	39	15.2	0.641 567	13.71	7.29	20	18	59
	2	1	03	39.89	6	46	22.4	0.648 914	13.55	7.21	20	15	48
	3	1	04	25.23	6	53	40.0	0.656 338	13.40	7.13	20	12	39
	4	1	05	12.86	+7	01	07.8	0.663 837	13.25	7.05	20	09	32
	5	1	06	02.74	7	08	45.2	0.671 410	13.10	6.97	20	06	28
	6	1	06	54.81	7	16	32.2	0.679 056	12.95	6.89	20	03	25
	7	1	07	49.04	7	24	28.4	0.686 772	12.81	6.81	20	00	25
	8	1	08	45.39	7	32	33.5	0.694 559	12.66	6.74	19	57	27
	9	1	09	43.82	7	40	47.3	0.702 414	12.52	6.66	19	54	31
	10	1	10	44.29	+7	49	09.5	0.710 336	12.38	6.59	19	51	37
	11	1	11	46.77	7	57	40.0	0.718 325	12.24	6.52	19	48	45
	12	1	12	51.23	8	06	18.5	0.726 377	12.11	6.44	19	45	55
	13	1	13	57.64	8	15	04.8	0.734 493	11.97	6.37	19	43	06
	14	1	15	05.95	8	23	58.6	0.742 670	11.84	6.30	19	40	20
	15	1	16	16.13	8	32	59.8	0.750 906	11.71	6.23	19	37	35
	16	1	17	28.14	+8	42	08.0	0.759 200	11.58	6.16	19	34	53
	17	1	18	41.95	8	51	23.1	0.767 550	11.46	6.10	19	32	12
	18	1	19	57.50	9	00	44.7	0.775 954	11.33	6.03	19	29	32
	19	1	21	14.77	9	10	12.6	0.784 410	11.21	5.97	19	26	55
	20	1	22	33.70	9	19	46.4	0.792 918	11.09	5.90	19	24	19
	21	1	23	54.27	9	29	25.9	0.801 475	10.97	5.84	19	21	44
	22	1	25	16.43	+9	39	10.9	0.810 081	10.86	5.78	19	19	11
	23	1	26	40.15	9	49	01.0	0.818 733	10.74	5.72	19	16	40
	24	1	28	05.40	9	58	56.1	0.827 430	10.63	5.66	19	14	10
	25	1	29	32.13	10	08	55.7	0.836 172	10.52	5.60	19	11	42
	26	1	31	00.31	10	18	59.7	0.844 957	10.41	5.54	19	09	15
	27	1	32	29.90	10	29	07.8	0.853 785	10.30	5.48	19	06	49
	28	1	34	00.89	+10	39	19.7	0.862 653	10.19	5.43	19	04	25
	29	1	35	33.23	10	49	35.2	0.871 562	10.09	5.37	19	02	02
	30	1	37	06.89	10	59	54.0	0.880 510	9.99	5.32	18	59	40
	31	1	38	41.85	11	10	15.9	0.889 496	9.89	5.26	18	57	20
	32	1	40	18.07	+11	20	40.7	0.898 521	9.79	5.21	18	55	01

JUPITER, 2020

HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector	Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector
	° ′ ″	° ′ ″			° ′ ″	° ′ ″	
Jan. 1	276 03 21.3	+0 06 18.6	5.227 578	Apr. 2	283 40 12.4	-0 04 04.1	5.193 861
3	276 13 13.4	0 06 05.2	5.226 849	4	283 50 12.3	0 04 17.7	5.193 126
5	276 23 05.7	0 05 51.8	5.226 120	6	284 00 12.3	0 04 31.4	5.192 391
7	276 32 58.2	0 05 38.3	5.225 391	8	284 10 12.5	0 04 45.0	5.191 655
9	276 42 50.8	0 05 24.9	5.224 662	10	284 20 12.9	0 04 58.6	5.190 920
11	276 52 43.6	0 05 11.4	5.223 932	12	284 30 13.4	0 05 12.3	5.190 185
13	277 02 36.6	+0 04 58.0	5.223 202	14	284 40 14.1	-0 05 25.9	5.189 449
15	277 12 29.7	0 04 44.5	5.222 472	16	284 50 15.0	0 05 39.5	5.188 714
17	277 22 23.0	0 04 31.1	5.221 741	18	285 00 16.1	0 05 53.1	5.187 979
19	277 32 16.5	0 04 17.6	5.221 011	20	285 10 17.3	0 06 06.8	5.187 244
21	277 42 10.1	0 04 04.1	5.220 280	22	285 20 18.7	0 06 20.4	5.186 508
23	277 52 03.9	0 03 50.6	5.219 549	24	285 30 20.3	0 06 34.0	5.185 773
25	278 01 57.9	+0 03 37.1	5.218 817	26	285 40 22.0	-0 06 47.6	5.185 038
27	278 11 52.0	0 03 23.6	5.218 086	28	285 50 23.9	0 07 01.3	5.184 303
29	278 21 46.3	0 03 10.1	5.217 354	30	286 00 26.0	0 07 14.9	5.183 568
31	278 31 40.7	0 02 56.6	5.216 622	May 2	286 10 28.2	0 07 28.5	5.182 834
Feb. 2	278 41 35.4	0 02 43.1	5.215 890	4	286 20 30.7	0 07 42.2	5.182 099
4	278 51 30.2	0 02 29.6	5.215 157	6	286 30 33.3	0 07 55.8	5.181 364
6	279 01 25.2	+0 02 16.1	5.214 424	8	286 40 36.0	-0 08 09.5	5.180 630
8	279 11 20.3	0 02 02.6	5.213 692	10	286 50 38.9	0 08 23.1	5.179 895
10	279 21 15.6	0 01 49.0	5.212 959	12	287 00 42.1	0 08 36.7	5.179 161
12	279 31 11.0	0 01 35.5	5.212 226	14	287 10 45.4	0 08 50.3	5.178 426
14	279 41 06.6	0 01 21.9	5.211 492	16	287 20 48.8	0 09 04.0	5.177 692
16	279 51 02.5	0 01 08.4	5.210 759	18	287 30 52.4	0 09 17.6	5.176 958
18	280 00 58.4	+0 00 54.9	5.210 025	20	287 40 56.2	-0 09 31.2	5.176 224
20	280 10 54.6	0 00 41.3	5.209 292	22	287 51 00.2	0 09 44.8	5.175 491
22	280 20 50.8	0 00 27.7	5.208 558	24	288 01 04.3	0 09 58.5	5.174 757
24	280 30 47.3	0 00 14.2	5.207 824	26	288 11 08.6	0 10 12.1	5.174 023
26	280 40 44.0	+0 00 00.6	5.207 090	28	288 21 13.1	0 10 25.7	5.173 290
28	280 50 40.8	-0 00 13.0	5.206 355	30	288 31 17.8	0 10 39.3	5.172 557
Mar. 1	281 00 37.8	-0 00 26.5	5.205 621	June 1	288 41 22.6	-0 10 53.0	5.171 824
3	281 10 34.9	0 00 40.1	5.204 887	3	288 51 27.6	0 11 06.6	5.171 091
5	281 20 32.2	0 00 53.7	5.204 152	5	289 01 32.8	0 11 20.2	5.170 358
7	281 30 29.7	0 01 07.3	5.203 417	7	289 11 38.1	0 11 33.8	5.169 626
9	281 40 27.4	0 01 20.9	5.202 683	9	289 21 43.6	0 11 47.4	5.168 894
11	281 50 25.2	0 01 34.4	5.201 948	11	289 31 49.3	0 12 01.0	5.168 162
13	282 00 23.2	-0 01 48.0	5.201 213	13	289 41 55.2	-0 12 14.6	5.167 430
15	282 10 21.3	0 02 01.6	5.200 478	15	289 52 01.2	0 12 28.3	5.166 698
17	282 20 19.7	0 02 15.3	5.199 743	17	290 02 07.4	0 12 41.9	5.165 967
19	282 30 18.1	0 02 28.9	5.199 008	19	290 12 13.8	0 12 55.5	5.165 235
21	282 40 16.8	0 02 42.5	5.198 273	21	290 22 20.4	0 13 09.1	5.164 504
23	282 50 15.7	0 02 56.1	5.197 538	23	290 32 27.1	0 13 22.7	5.163 774
25	283 00 14.7	-0 03 09.7	5.196 802	25	290 42 34.0	-0 13 36.2	5.163 043
27	283 10 13.9	0 03 23.3	5.196 067	27	290 52 41.1	0 13 49.8	5.162 313
29	283 20 13.2	0 03 36.9	5.195 332	29	291 02 48.3	0 14 03.4	5.161 583
31	283 30 12.7	0 03 50.5	5.194 597	July 1	291 12 55.7	0 14 17.0	5.160 853
Apr. 2	283 40 12.4	-0 04 04.1	5.193 861	3	291 23 03.3	-0 14 30.6	5.160 123

JUPITER, 2020

HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME

MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude			Heliocentric Latitude			Radius Vector	Date		Heliocentric Longitude			Heliocentric Latitude			Radius Vector
		°	'	"	°	'	"				°	'	"	°	'	"	
July	1	291	12	55.7	-0	14	17.0	5.160 853	Oct.	1	299	01	42.3	-0	24	35.8	5.127 677
	3	291	23	03.3	0	14	30.6	5.160 123		3	299	11	57.8	0	24	49.1	5.126 967
	5	291	33	11.0	0	14	44.1	5.159 394		5	299	22	13.5	0	25	02.4	5.126 258
	7	291	43	19.0	0	14	57.7	5.158 665		7	299	32	29.3	0	25	15.6	5.125 549
	9	291	53	27.1	0	15	11.3	5.157 936		9	299	42	45.3	0	25	28.9	5.124 840
	11	292	03	35.3	0	15	24.9	5.157 208		11	299	53	01.4	0	25	42.1	5.124 133
	13	292	13	43.8	-0	15	38.4	5.156 480		13	300	03	17.8	-0	25	55.3	5.123 426
	15	292	23	52.4	0	15	52.0	5.155 752		15	300	13	34.3	0	26	08.6	5.122 719
	17	292	34	01.2	0	16	05.5	5.155 025		17	300	23	51.0	0	26	21.8	5.122 013
	19	292	44	10.1	0	16	19.0	5.154 298		19	300	34	07.8	0	26	34.9	5.121 308
	21	292	54	19.3	0	16	32.6	5.153 571		21	300	44	24.8	0	26	48.1	5.120 603
	23	293	04	28.5	0	16	46.1	5.152 844		23	300	54	42.0	0	27	01.3	5.119 899
	25	293	14	38.0	-0	16	59.7	5.152 118		25	301	04	59.3	-0	27	14.5	5.119 196
	27	293	24	47.7	0	17	13.2	5.151 392		27	301	15	16.9	0	27	27.6	5.118 493
	29	293	34	57.5	0	17	26.7	5.150 667		29	301	25	34.5	0	27	40.8	5.117 791
	31	293	45	07.5	0	17	40.2	5.149 942		31	301	35	52.4	0	27	53.9	5.117 090
Aug.	2	293	55	17.7	0	17	53.7	5.149 217	Nov.	2	301	46	10.4	0	28	07.0	5.116 389
	4	294	05	28.0	0	18	07.2	5.148 492		4	301	56	28.7	0	28	20.1	5.115 689
	6	294	15	38.5	-0	18	20.7	5.147 768		6	302	06	47.0	-0	28	33.2	5.114 990
	8	294	25	49.2	0	18	34.2	5.147 045		8	302	17	05.6	0	28	46.3	5.114 291
	10	294	36	00.0	0	18	47.7	5.146 322		10	302	27	24.3	0	28	59.4	5.113 593
	12	294	46	11.0	0	19	01.2	5.145 599		12	302	37	43.1	0	29	12.4	5.112 896
	14	294	56	22.2	0	19	14.6	5.144 876		14	302	48	02.2	0	29	25.5	5.112 200
	16	295	06	33.6	0	19	28.1	5.144 154		16	302	58	21.4	0	29	38.5	5.111 504
	18	295	16	45.1	-0	19	41.6	5.143 433		18	303	08	40.8	-0	29	51.5	5.110 809
	20	295	26	56.9	0	19	55.0	5.142 712		20	303	19	00.4	0	30	04.5	5.110 114
	22	295	37	08.7	0	20	08.5	5.141 991		22	303	29	20.1	0	30	17.5	5.109 421
	24	295	47	20.8	0	20	21.9	5.141 271		24	303	39	40.0	0	30	30.5	5.108 728
	26	295	57	33.0	0	20	35.4	5.140 551		26	303	50	00.0	0	30	43.5	5.108 036
	28	296	07	45.4	0	20	48.8	5.139 831		28	304	00	20.3	0	30	56.4	5.107 345
	30	296	17	58.0	-0	21	02.2	5.139 112		30	304	10	40.7	-0	31	09.4	5.106 654
Sept.	1	296	28	10.7	0	21	15.6	5.138 394	Dec.	2	304	21	01.2	0	31	22.3	5.105 964
	3	296	38	23.6	0	21	29.0	5.137 676		4	304	31	22.0	0	31	35.2	5.105 275
	5	296	48	36.7	0	21	42.4	5.136 958		6	304	41	42.9	0	31	48.1	5.104 587
	7	296	58	49.9	0	21	55.8	5.136 241		8	304	52	04.0	0	32	01.0	5.103 899
	9	297	09	03.4	0	22	09.2	5.135 525		10	305	02	25.2	0	32	13.9	5.103 213
	11	297	19	17.0	-0	22	22.6	5.134 809		12	305	12	46.6	-0	32	26.8	5.102 527
	13	297	29	30.7	0	22	35.9	5.134 093		14	305	23	08.1	0	32	39.6	5.101 842
	15	297	39	44.7	0	22	49.3	5.133 378		16	305	33	29.9	0	32	52.4	5.101 158
	17	297	49	58.8	0	23	02.6	5.132 664		18	305	43	51.8	0	33	05.3	5.100 474
	19	298	00	13.1	0	23	16.0	5.131 950		20	305	54	13.9	0	33	18.1	5.099 792
	21	298	10	27.5	0	23	29.3	5.131 236		22	306	04	36.1	0	33	30.8	5.099 110
	23	298	20	42.2	-0	23	42.6	5.130 523		24	306	14	58.6	-0	33	43.6	5.098 429
	25	298	30	56.9	0	23	55.9	5.129 811		26	306	25	21.1	0	33	56.4	5.097 749
	27	298	41	11.9	0	24	09.2	5.129 099		28	306	35	43.9	0	34	09.1	5.097 070
	29	298	51	27.0	0	24	22.5	5.128 388		30	306	46	06.8	0	34	21.9	5.096 391
Oct.	1	299	01	42.3	-0	24	35.8	5.127 677		32	306	56	29.9	-0	34	34.6	5.095 714

JUPITER, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Jan.	0	276	26	22.9	+0	05	24.5	Feb.	15	286	37	27.8	+0	01	06.3
	1	276	40	12.6	0	05	18.9		16	286	49	40.6	0	01	00.4
	2	276	54	02.0	0	05	13.3		17	287	01	49.3	0	00	54.5
	3	277	07	51.0	0	05	07.7		18	287	13	53.8	0	00	48.6
	4	277	21	39.6	0	05	02.1		19	287	25	54.0	0	00	42.7
	5	277	35	27.7	0	04	56.6		20	287	37	49.8	0	00	36.8
	6	277	49	15.2	+0	04	51.0		21	287	49	41.0	+0	00	30.8
	7	278	03	02.0	0	04	45.4		22	288	01	27.6	0	00	24.8
	8	278	16	48.2	0	04	39.9		23	288	13	09.5	0	00	18.8
	9	278	30	33.6	0	04	34.4		24	288	24	46.5	0	00	12.8
	10	278	44	18.0	0	04	28.8		25	288	36	18.5	0	00	06.8
	11	278	58	01.6	0	04	23.3		26	288	47	45.5	+0	00	00.7
	12	279	11	44.0	+0	04	17.8		27	288	59	07.4	-0	00	05.4
	13	279	25	25.3	0	04	12.2		28	289	10	24.1	0	00	11.5
	14	279	39	05.4	0	04	06.7		29	289	21	35.5	0	00	17.6
	15	279	52	44.1	0	04	01.2	Mar.	1	289	32	41.6	0	00	23.8
	16	280	06	21.5	0	03	55.6		2	289	43	42.1	0	00	29.9
	17	280	19	57.5	0	03	50.1		3	289	54	37.2	0	00	36.1
	18	280	33	32.1	+0	03	44.5		4	290	05	26.6	-0	00	42.4
	19	280	47	05.1	0	03	39.0		5	290	16	10.2	0	00	48.6
	20	281	00	36.5	0	03	33.4		6	290	26	48.1	0	00	54.9
	21	281	14	06.1	0	03	27.8		7	290	37	19.9	0	01	01.2
	22	281	27	34.0	0	03	22.2		8	290	47	45.7	0	01	07.6
	23	281	40	59.9	0	03	16.7		9	290	58	05.4	0	01	14.0
	24	281	54	23.7	+0	03	11.1		10	291	08	18.8	-0	01	20.4
	25	282	07	45.4	0	03	05.5		11	291	18	26.0	0	01	26.9
	26	282	21	04.8	0	02	59.9		12	291	28	26.8	0	01	33.4
	27	282	34	21.8	0	02	54.3		13	291	38	21.2	0	01	39.9
	28	282	47	36.3	0	02	48.7		14	291	48	09.1	0	01	46.5
	29	283	00	48.4	0	02	43.1		15	291	57	50.4	0	01	53.1
	30	283	13	57.7	+0	02	37.4		16	292	07	25.0	-0	01	59.8
	31	283	27	04.5	0	02	31.8		17	292	16	52.7	0	02	06.5
Feb.	1	283	40	08.4	0	02	26.2		18	292	26	13.5	0	02	13.2
	2	283	53	09.5	0	02	20.6		19	292	35	27.1	0	02	20.0
	3	284	06	07.7	0	02	14.9		20	292	44	33.5	0	02	26.8
	4	284	19	02.9	0	02	09.3		21	292	53	32.5	0	02	33.6
	5	284	31	55.0	+0	02	03.7		22	293	02	24.0	-0	02	40.5
	6	284	44	44.0	0	01	58.0		23	293	11	08.0	0	02	47.4
	7	284	57	29.8	0	01	52.3		24	293	19	44.3	0	02	54.4
	8	285	10	12.1	0	01	46.6		25	293	28	12.8	0	03	01.4
	9	285	22	51.1	0	01	40.9		26	293	36	33.5	0	03	08.4
	10	285	35	26.5	0	01	35.2		27	293	44	46.3	0	03	15.5
	11	285	47	58.2	+0	01	29.5		28	293	52	51.0	-0	03	22.6
	12	286	00	26.3	0	01	23.7		29	294	00	47.7	0	03	29.7
	13	286	12	50.6	0	01	17.9		30	294	08	36.1	0	03	36.9
	14	286	25	11.2	0	01	12.1		31	294	16	16.2	0	03	44.1
	15	286	37	27.8	+0	01	06.3	Apr.	1	294	23	48.0	-0	03	51.4

JUPITER, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Apr.	1	294	23	48.0	-0	03	51.4	May	17	297	13	52.4	-0	10	18.9
	2	294	31	11.2	0	03	58.7		18	297	13	19.2	0	10	28.4
	3	294	38	25.8	0	04	06.0		19	297	12	34.6	0	10	38.0
	4	294	45	31.7	0	04	13.4		20	297	11	38.6	0	10	47.5
	5	294	52	28.8	0	04	20.9		21	297	10	31.3	0	10	57.2
	6	294	59	17.0	0	04	28.4		22	297	09	12.6	0	11	06.8
	7	295	05	56.2	-0	04	36.0		23	297	07	42.6	-0	11	16.5
	8	295	12	26.5	0	04	43.6		24	297	06	01.4	0	11	26.2
	9	295	18	47.6	0	04	51.3		25	297	04	09.0	0	11	35.9
	10	295	24	59.7	0	04	59.0		26	297	02	05.4	0	11	45.6
	11	295	31	02.5	0	05	06.7		27	296	59	50.7	0	11	55.4
	12	295	36	56.0	0	05	14.6		28	296	57	25.0	0	12	05.2
	13	295	42	40.0	-0	05	22.5		29	296	54	48.4	-0	12	15.1
	14	295	48	14.4	0	05	30.4		30	296	52	00.8	0	12	25.0
	15	295	53	39.1	0	05	38.4		31	296	49	02.5	0	12	34.8
	16	295	58	54.0	0	05	46.4	June	1	296	45	53.5	0	12	44.8
	17	296	03	59.0	0	05	54.4		2	296	42	34.0	0	12	54.7
	18	296	08	53.9	0	06	02.6		3	296	39	04.2	0	13	04.7
	19	296	13	38.6	-0	06	10.7		4	296	35	24.1	-0	13	14.7
	20	296	18	13.2	0	06	18.9		5	296	31	33.9	0	13	24.7
	21	296	22	37.5	0	06	27.2		6	296	27	33.7	0	13	34.7
	22	296	26	51.5	0	06	35.5		7	296	23	23.6	0	13	44.7
	23	296	30	55.0	0	06	43.8		8	296	19	03.6	0	13	54.8
	24	296	34	48.1	0	06	52.2		9	296	14	34.0	0	14	04.8
	25	296	38	30.6	-0	07	00.6		10	296	09	54.7	-0	14	14.8
	26	296	42	02.6	0	07	09.1		11	296	05	06.0	0	14	24.8
	27	296	45	23.8	0	07	17.7		12	296	00	08.0	0	14	34.8
	28	296	48	34.3	0	07	26.2		13	295	55	00.9	0	14	44.8
	29	296	51	34.0	0	07	34.9		14	295	49	44.8	0	14	54.8
	30	296	54	22.9	0	07	43.5		15	295	44	20.0	0	15	04.8
May	1	296	57	00.7	-0	07	52.3		16	295	38	46.7	-0	15	14.7
	2	296	59	27.6	0	08	01.0		17	295	33	05.0	0	15	24.7
	3	297	01	43.5	0	08	09.9		18	295	27	15.3	0	15	34.6
	4	297	03	48.2	0	08	18.8		19	295	21	17.7	0	15	44.4
	5	297	05	41.9	0	08	27.7		20	295	15	12.5	0	15	54.3
	6	297	07	24.6	0	08	36.7		21	295	09	00.0	0	16	04.1
	7	297	08	56.1	-0	08	45.8		22	295	02	40.3	-0	16	13.9
	8	297	10	16.6	0	08	54.9		23	294	56	13.7	0	16	23.6
	9	297	11	25.9	0	09	04.1		24	294	49	40.4	0	16	33.3
	10	297	12	24.0	0	09	13.3		25	294	43	00.8	0	16	43.0
	11	297	13	10.8	0	09	22.5		26	294	36	15.0	0	16	52.7
	12	297	13	46.3	0	09	31.8		27	294	29	23.4	0	17	02.3
	13	297	14	10.4	-0	09	41.2		28	294	22	26.4	-0	17	11.9
	14	297	14	23.1	0	09	50.5		29	294	15	24.1	0	17	21.4
	15	297	14	24.3	0	10	00.0		30	294	08	17.0	0	17	30.9
	16	297	14	14.1	0	10	09.4	July	1	294	01	05.4	0	17	40.4
	17	297	13	52.4	-0	10	18.9		2	293	53	49.5	-0	17	49.8

JUPITER, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
July	1	294	01	05.4	-0	17	40.4	Aug.	16	288	37	42.2	-0	23	23.4
	2	293	53	49.5	0	17	49.8		17	288	32	43.9	0	23	28.4
	3	293	46	29.7	0	17	59.1		18	288	27	54.9	0	23	33.4
	4	293	39	06.2	0	18	08.4		19	288	23	15.4	0	23	38.3
	5	293	31	39.3	0	18	17.6		20	288	18	45.5	0	23	43.1
	6	293	24	09.3	0	18	26.8		21	288	14	25.5	0	23	47.8
	7	293	16	36.4	-0	18	35.9		22	288	10	15.4	-0	23	52.4
	8	293	09	00.9	0	18	44.9		23	288	06	15.6	0	23	56.9
	9	293	01	23.2	0	18	53.8		24	288	02	26.2	0	24	01.4
	10	292	53	43.6	0	19	02.7		25	287	58	47.3	0	24	05.7
	11	292	46	02.3	0	19	11.4		26	287	55	19.0	0	24	10.0
	12	292	38	19.8	0	19	20.1		27	287	52	01.4	0	24	14.2
	13	292	30	36.4	-0	19	28.7		28	287	48	54.7	-0	24	18.3
	14	292	22	52.4	0	19	37.2		29	287	45	58.8	0	24	22.3
	15	292	15	08.1	0	19	45.6		30	287	43	13.8	0	24	26.2
	16	292	07	24.0	0	19	54.0		31	287	40	39.7	0	24	30.0
	17	291	59	40.4	0	20	02.2	Sept.	1	287	38	16.7	0	24	33.8
	18	291	51	57.5	0	20	10.3		2	287	36	04.8	0	24	37.4
	19	291	44	15.8	-0	20	18.4		3	287	34	04.1	-0	24	41.0
	20	291	36	35.5	0	20	26.3		4	287	32	14.5	0	24	44.5
	21	291	28	57.0	0	20	34.2		5	287	30	36.3	0	24	47.9
	22	291	21	20.6	0	20	42.0		6	287	29	09.5	0	24	51.2
	23	291	13	46.7	0	20	49.6		7	287	27	54.0	0	24	54.5
	24	291	06	15.6	0	20	57.2		8	287	26	50.1	0	24	57.7
	25	290	58	47.6	-0	21	04.7		9	287	25	57.6	-0	25	00.8
	26	290	51	23.1	0	21	12.1		10	287	25	16.7	0	25	03.8
	27	290	44	02.4	0	21	19.4		11	287	24	47.4	0	25	06.8
	28	290	36	45.9	0	21	26.6		12	287	24	29.7	0	25	09.7
	29	290	29	34.0	0	21	33.7		13	287	24	23.6	0	25	12.6
	30	290	22	26.8	0	21	40.7		14	287	24	29.0	0	25	15.4
	31	290	15	24.7	-0	21	47.7		15	287	24	46.1	-0	25	18.1
Aug.	1	290	08	27.9	0	21	54.5		16	287	25	14.7	0	25	20.8
	2	290	01	36.6	0	22	01.2		17	287	25	54.9	0	25	23.4
	3	289	54	51.2	0	22	07.7		18	287	26	46.8	0	25	26.0
	4	289	48	11.8	0	22	14.2		19	287	27	50.3	0	25	28.6
	5	289	41	38.6	0	22	20.6		20	287	29	05.4	0	25	31.1
	6	289	35	12.1	-0	22	26.9		21	287	30	32.2	-0	25	33.6
	7	289	28	52.3	0	22	33.0		22	287	32	10.6	0	25	36.0
	8	289	22	39.6	0	22	39.0		23	287	34	00.5	0	25	38.4
	9	289	16	34.2	0	22	45.0		24	287	36	01.9	0	25	40.7
	10	289	10	36.5	0	22	50.8		25	287	38	14.6	0	25	43.0
	11	289	04	46.5	0	22	56.5		26	287	40	38.7	0	25	45.3
	12	288	59	04.6	-0	23	02.1		27	287	43	14.0	-0	25	47.5
	13	288	53	31.0	0	23	07.5		28	287	46	00.4	0	25	49.6
	14	288	48	06.0	0	23	12.9		29	287	48	57.9	0	25	51.8
	15	288	42	49.6	0	23	18.2		30	287	52	06.4	0	25	53.9
	16	288	37	42.2	-0	23	23.4	Oct.	1	287	55	25.8	-0	25	55.9

JUPITER, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Oct.	1	287	55	25.8	-0	25	55.9	Nov.	16	293	23	06.9	-0	27	19.4
	2	287	58	56.2	0	25	58.0		17	293	33	26.9	0	27	21.4
	3	288	02	37.4	0	26	00.0		18	293	43	53.5	0	27	23.4
	4	288	06	29.4	0	26	01.9		19	293	54	26.5	0	27	25.5
	5	288	10	32.1	0	26	03.8		20	294	05	06.0	0	27	27.6
	6	288	14	45.6	0	26	05.7		21	294	15	51.6	0	27	29.7
	7	288	19	09.6	-0	26	07.6		22	294	26	43.3	-0	27	31.8
	8	288	23	44.2	0	26	09.5		23	294	37	41.0	0	27	33.9
	9	288	28	29.2	0	26	11.3		24	294	48	44.6	0	27	36.1
	10	288	33	24.6	0	26	13.1		25	294	59	54.1	0	27	38.3
	11	288	38	30.2	0	26	14.9		26	295	11	09.2	0	27	40.5
	12	288	43	46.1	0	26	16.7		27	295	22	30.0	0	27	42.7
	13	288	49	12.1	-0	26	18.5		28	295	33	56.4	-0	27	45.0
	14	288	54	48.1	0	26	20.3		29	295	45	28.2	0	27	47.3
	15	289	00	34.0	0	26	22.0		30	295	57	05.4	0	27	49.6
	16	289	06	29.9	0	26	23.8	Dec.	1	296	08	47.9	0	27	51.9
	17	289	12	35.6	0	26	25.6		2	296	20	35.5	0	27	54.3
	18	289	18	51.1	0	26	27.3		3	296	32	28.3	0	27	56.7
	19	289	25	16.3	-0	26	29.1		4	296	44	26.0	-0	27	59.2
	20	289	31	51.1	0	26	30.8		5	296	56	28.6	0	28	01.6
	21	289	38	35.4	0	26	32.6		6	297	08	36.0	0	28	04.1
	22	289	45	29.0	0	26	34.3		7	297	20	48.0	0	28	06.7
	23	289	52	31.8	0	26	36.1		8	297	33	04.7	0	28	09.3
	24	289	59	43.6	0	26	37.8		9	297	45	25.9	0	28	11.9
	25	290	07	04.4	-0	26	39.6		10	297	57	51.6	-0	28	14.6
	26	290	14	34.0	0	26	41.3		11	298	10	21.7	0	28	17.3
	27	290	22	12.3	0	26	43.0		12	298	22	56.2	0	28	20.1
	28	290	29	59.3	0	26	44.8		13	298	35	34.9	0	28	22.9
	29	290	37	54.8	0	26	46.5		14	298	48	17.8	0	28	25.7
	30	290	45	58.7	0	26	48.2		15	299	01	04.8	0	28	28.6
	31	290	54	11.0	-0	26	50.0		16	299	13	55.7	-0	28	31.5
Nov.	1	291	02	31.6	0	26	51.7		17	299	26	50.3	0	28	34.5
	2	291	11	00.4	0	26	53.4		18	299	39	48.6	0	28	37.4
	3	291	19	37.2	0	26	55.2		19	299	52	50.5	0	28	40.5
	4	291	28	22.0	0	26	56.9		20	300	05	55.8	0	28	43.5
	5	291	37	14.8	0	26	58.7		21	300	19	04.4	0	28	46.7
	6	291	46	15.3	-0	27	00.5		22	300	32	16.3	-0	28	49.8
	7	291	55	23.5	0	27	02.3		23	300	45	31.4	0	28	53.0
	8	292	04	39.2	0	27	04.1		24	300	58	49.6	0	28	56.2
	9	292	14	02.4	0	27	05.9		25	301	12	10.9	0	28	59.5
	10	292	23	33.0	0	27	07.8		26	301	25	35.1	0	29	02.8
	11	292	33	10.9	0	27	09.7		27	301	39	02.3	0	29	06.1
	12	292	42	55.9	-0	27	11.5		28	301	52	32.2	-0	29	09.5
	13	292	52	48.1	0	27	13.5		29	302	06	04.8	0	29	12.9
	14	293	02	47.4	0	27	15.4		30	302	19	40.1	0	29	16.4
	15	293	12	53.7	0	27	17.4		31	302	33	17.8	0	29	19.9
	16	293	23	06.9	-0	27	19.4		32	302	46	58.0	-0	29	23.5

JUPITER, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Jan.	0	18	28	02.02	-23	11	22.3	6.210 104	1.42	14.82	11	50	03
	1	18	29	02.14	23	10	47.0	6.208 890	1.42	14.83	11	47	07
	2	18	30	02.23	23	10	10.2	6.207 460	1.42	14.83	11	44	11
	3	18	31	02.28	23	09	32.0	6.205 813	1.42	14.83	11	41	15
	4	18	32	02.29	23	08	52.4	6.203 951	1.42	14.84	11	38	19
	5	18	33	02.26	23	08	11.4	6.201 874	1.42	14.84	11	35	23
	6	18	34	02.17	-23	07	28.9	6.199 583	1.42	14.85	11	32	26
	7	18	35	02.02	23	06	45.0	6.197 078	1.42	14.86	11	29	30
	8	18	36	01.81	23	05	59.8	6.194 359	1.42	14.86	11	26	33
	9	18	37	01.54	23	05	13.2	6.191 428	1.42	14.87	11	23	37
	10	18	38	01.19	23	04	25.3	6.188 285	1.42	14.88	11	20	40
	11	18	39	00.75	23	03	36.1	6.184 931	1.42	14.88	11	17	44
	12	18	40	00.23	-23	02	45.6	6.181 366	1.42	14.89	11	14	47
	13	18	40	59.61	23	01	53.7	6.177 590	1.42	14.90	11	11	50
	14	18	41	58.89	23	01	00.6	6.173 604	1.42	14.91	11	08	53
	15	18	42	58.06	23	00	06.2	6.169 408	1.43	14.92	11	05	56
	16	18	43	57.12	22	59	10.5	6.165 003	1.43	14.93	11	02	59
	17	18	44	56.07	22	58	13.5	6.160 389	1.43	14.94	11	00	01
	18	18	45	54.89	-22	57	15.2	6.155 566	1.43	14.96	10	57	04
	19	18	46	53.60	22	56	15.7	6.150 534	1.43	14.97	10	54	07
	20	18	47	52.16	22	55	15.0	6.145 294	1.43	14.98	10	51	09
	21	18	48	50.60	22	54	13.1	6.139 847	1.43	14.99	10	48	11
	22	18	49	48.88	22	53	10.0	6.134 193	1.43	15.01	10	45	13
	23	18	50	47.01	22	52	05.8	6.128 333	1.43	15.02	10	42	15
	24	18	51	44.98	-22	51	00.5	6.122 268	1.44	15.04	10	39	17
	25	18	52	42.77	22	49	54.1	6.116 000	1.44	15.05	10	36	18
	26	18	53	40.38	22	48	46.6	6.109 528	1.44	15.07	10	33	19
	27	18	54	37.81	22	47	38.0	6.102 856	1.44	15.08	10	30	21
	28	18	55	35.05	22	46	28.4	6.095 983	1.44	15.10	10	27	22
	29	18	56	32.08	22	45	17.8	6.088 911	1.44	15.12	10	24	22
	30	18	57	28.91	-22	44	06.1	6.081 642	1.45	15.14	10	21	23
	31	18	58	25.53	22	42	53.4	6.074 178	1.45	15.16	10	18	23
Feb.	1	18	59	21.93	22	41	39.8	6.066 519	1.45	15.18	10	15	23
	2	19	00	18.12	22	40	25.2	6.058 668	1.45	15.19	10	12	23
	3	19	01	14.07	22	39	09.6	6.050 626	1.45	15.21	10	09	23
	4	19	02	09.80	22	37	53.2	6.042 395	1.46	15.24	10	06	22
	5	19	03	05.29	-22	36	36.0	6.033 975	1.46	15.26	10	03	22
	6	19	04	00.53	22	35	17.9	6.025 370	1.46	15.28	10	00	21
	7	19	04	55.52	22	33	59.0	6.016 581	1.46	15.30	9	57	19
	8	19	05	50.26	22	32	39.4	6.007 609	1.46	15.32	9	54	18
	9	19	06	44.73	22	31	19.0	5.998 456	1.47	15.35	9	51	16
	10	19	07	38.93	22	29	58.0	5.989 123	1.47	15.37	9	48	14
	11	19	08	32.85	-22	28	36.2	5.979 611	1.47	15.40	9	45	12
	12	19	09	26.49	22	27	13.7	5.969 923	1.47	15.42	9	42	09
	13	19	10	19.84	22	25	50.6	5.960 059	1.48	15.45	9	39	06
	14	19	11	12.91	22	24	26.9	5.950 020	1.48	15.47	9	36	03
	15	19	12	05.68	-22	23	02.5	5.939 809	1.48	15.50	9	32	59

JUPITER, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Feb.	15	19	12	05.68	-22	23	02.5	5.939 809	1.48	15.50	9	32	59
	16	19	12	58.15	22	21	37.6	5.929 425	1.48	15.53	9	29	55
	17	19	13	50.31	22	20	12.2	5.918 872	1.49	15.55	9	26	51
	18	19	14	42.16	22	18	46.3	5.908 150	1.49	15.58	9	23	47
	19	19	15	33.69	22	17	19.9	5.897 261	1.49	15.61	9	20	42
	20	19	16	24.88	22	15	53.2	5.886 207	1.49	15.64	9	17	37
	21	19	17	15.73	-22	14	26.1	5.874 990	1.50	15.67	9	14	32
	22	19	18	06.22	22	12	58.6	5.863 613	1.50	15.70	9	11	26
	23	19	18	56.37	22	11	30.8	5.852 077	1.50	15.73	9	08	20
	24	19	19	46.15	22	10	02.8	5.840 385	1.51	15.76	9	05	13
	25	19	20	35.56	22	08	34.5	5.828 539	1.51	15.79	9	02	06
	26	19	21	24.59	22	07	05.9	5.816 541	1.51	15.83	8	58	59
	27	19	22	13.24	-22	05	37.2	5.804 394	1.52	15.86	8	55	51
	28	19	23	01.50	22	04	08.3	5.792 101	1.52	15.89	8	52	43
	29	19	23	49.37	22	02	39.3	5.779 663	1.52	15.93	8	49	35
Mar.	1	19	24	36.84	22	01	10.2	5.767 085	1.52	15.96	8	46	26
	2	19	25	23.91	21	59	41.0	5.754 367	1.53	16.00	8	43	17
	3	19	26	10.57	21	58	11.9	5.741 513	1.53	16.03	8	40	07
	4	19	26	56.81	-21	56	42.8	5.728 526	1.54	16.07	8	36	57
	5	19	27	42.63	21	55	13.8	5.715 408	1.54	16.11	8	33	47
	6	19	28	28.01	21	53	44.9	5.702 161	1.54	16.14	8	30	36
	7	19	29	12.96	21	52	16.2	5.688 789	1.55	16.18	8	27	24
	8	19	29	57.46	21	50	47.7	5.675 294	1.55	16.22	8	24	13
	9	19	30	41.52	21	49	19.4	5.661 678	1.55	16.26	8	21	00
	10	19	31	25.11	-21	47	51.4	5.647 943	1.56	16.30	8	17	48
	11	19	32	08.25	21	46	23.7	5.634 092	1.56	16.34	8	14	35
	12	19	32	50.92	21	44	56.3	5.620 127	1.56	16.38	8	11	21
	13	19	33	33.12	21	43	29.2	5.606 051	1.57	16.42	8	08	07
	14	19	34	14.85	21	42	02.5	5.591 865	1.57	16.46	8	04	52
	15	19	34	56.10	21	40	36.3	5.577 572	1.58	16.51	8	01	37
	16	19	35	36.86	-21	39	10.6	5.563 174	1.58	16.55	7	58	22
	17	19	36	17.12	21	37	45.4	5.548 674	1.58	16.59	7	55	06
	18	19	36	56.87	21	36	20.8	5.534 075	1.59	16.64	7	51	49
	19	19	37	36.11	21	34	56.8	5.519 380	1.59	16.68	7	48	32
	20	19	38	14.82	21	33	33.5	5.504 591	1.60	16.72	7	45	15
	21	19	38	53.00	21	32	10.9	5.489 713	1.60	16.77	7	41	57
	22	19	39	30.64	-21	30	49.1	5.474 747	1.61	16.82	7	38	38
	23	19	40	07.74	21	29	28.0	5.459 697	1.61	16.86	7	35	19
	24	19	40	44.28	21	28	07.7	5.444 566	1.62	16.91	7	31	59
	25	19	41	20.26	21	26	48.3	5.429 359	1.62	16.96	7	28	39
	26	19	41	55.68	21	25	29.8	5.414 077	1.62	17.00	7	25	18
	27	19	42	30.53	21	24	12.1	5.398 725	1.63	17.05	7	21	57
	28	19	43	04.81	-21	22	55.5	5.383 306	1.63	17.10	7	18	35
	29	19	43	38.50	21	21	39.9	5.367 824	1.64	17.15	7	15	12
	30	19	44	11.61	21	20	25.3	5.352 282	1.64	17.20	7	11	49
	31	19	44	44.12	21	19	11.8	5.336 684	1.65	17.25	7	08	25
Apr.	1	19	45	16.04	-21	17	59.5	5.321 033	1.65	17.30	7	05	01

JUPITER, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Apr.	1	19	45	16.04	-21	17	59.5	5.321 033	1.65	17.30	7	05	01
	2	19	45	47.34	21	16	48.4	5.305 333	1.66	17.35	7	01	36
	3	19	46	18.03	21	15	38.5	5.289 587	1.66	17.40	6	58	10
	4	19	46	48.11	21	14	29.9	5.273 798	1.67	17.46	6	54	44
	5	19	47	17.55	21	13	22.5	5.257 971	1.67	17.51	6	51	17
	6	19	47	46.36	21	12	16.5	5.242 109	1.68	17.56	6	47	50
	7	19	48	14.54	-21	11	11.9	5.226 214	1.68	17.62	6	44	22
	8	19	48	42.07	21	10	08.6	5.210 289	1.69	17.67	6	40	53
	9	19	49	08.97	21	09	06.8	5.194 339	1.69	17.72	6	37	24
	10	19	49	35.21	21	08	06.4	5.178 365	1.70	17.78	6	33	54
	11	19	50	00.80	21	07	07.4	5.162 372	1.70	17.83	6	30	23
	12	19	50	25.74	21	06	10.0	5.146 362	1.71	17.89	6	26	52
	13	19	50	50.00	-21	05	14.2	5.130 339	1.71	17.94	6	23	20
	14	19	51	13.59	21	04	20.1	5.114 306	1.72	18.00	6	19	47
	15	19	51	36.48	21	03	27.6	5.098 267	1.72	18.06	6	16	14
	16	19	51	58.69	21	02	36.8	5.082 226	1.73	18.11	6	12	40
	17	19	52	20.20	21	01	47.7	5.066 186	1.74	18.17	6	09	05
	18	19	52	40.99	21	01	00.4	5.050 152	1.74	18.23	6	05	30
	19	19	53	01.08	-21	00	14.9	5.034 128	1.75	18.29	6	01	54
	20	19	53	20.45	20	59	31.2	5.018 117	1.75	18.35	5	58	17
	21	19	53	39.09	20	58	49.4	5.002 125	1.76	18.40	5	54	40
	22	19	53	57.00	20	58	09.4	4.986 154	1.76	18.46	5	51	01
	23	19	54	14.19	20	57	31.3	4.970 209	1.77	18.52	5	47	22
	24	19	54	30.64	20	56	55.1	4.954 296	1.78	18.58	5	43	43
	25	19	54	46.34	-20	56	20.9	4.938 417	1.78	18.64	5	40	02
	26	19	55	01.31	20	55	48.6	4.922 577	1.79	18.70	5	36	21
	27	19	55	15.52	20	55	18.4	4.906 781	1.79	18.76	5	32	39
	28	19	55	28.98	20	54	50.3	4.891 032	1.80	18.82	5	28	56
	29	19	55	41.69	20	54	24.2	4.875 336	1.80	18.88	5	25	13
	30	19	55	53.63	20	54	00.2	4.859 696	1.81	18.94	5	21	29
May	1	19	56	04.80	-20	53	38.4	4.844 117	1.82	19.00	5	17	44
	2	19	56	15.21	20	53	18.7	4.828 602	1.82	19.07	5	13	58
	3	19	56	24.84	20	53	01.1	4.813 156	1.83	19.13	5	10	11
	4	19	56	33.70	20	52	45.7	4.797 783	1.83	19.19	5	06	24
	5	19	56	41.78	20	52	32.4	4.782 486	1.84	19.25	5	02	36
	6	19	56	49.09	20	52	21.3	4.767 269	1.84	19.31	4	58	47
	7	19	56	55.62	-20	52	12.4	4.752 137	1.85	19.37	4	54	58
	8	19	57	01.38	20	52	05.7	4.737 092	1.86	19.43	4	51	07
	9	19	57	06.35	20	52	01.1	4.722 139	1.86	19.50	4	47	16
	10	19	57	10.55	20	51	58.8	4.707 282	1.87	19.56	4	43	24
	11	19	57	13.95	20	51	58.7	4.692 523	1.87	19.62	4	39	32
	12	19	57	16.57	20	52	01.0	4.677 869	1.88	19.68	4	35	38
	13	19	57	18.38	-20	52	05.4	4.663 322	1.89	19.74	4	31	44
	14	19	57	19.40	20	52	12.2	4.648 888	1.89	19.80	4	27	49
	15	19	57	19.62	20	52	21.2	4.634 570	1.90	19.86	4	23	53
	16	19	57	19.03	20	52	32.5	4.620 374	1.90	19.92	4	19	56
	17	19	57	17.65	-20	52	46.0	4.606 302	1.91	19.99	4	15	59

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RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
May	17	19	57	17.65	-20	52	46.0	4.606 302	1.91	19.99	4	15	59
	18	19	57	15.46	20	53	01.8	4.592 361	1.91	20.05	4	12	01
	19	19	57	12.47	20	53	19.9	4.578 555	1.92	20.11	4	08	02
	20	19	57	08.68	20	53	40.1	4.564 888	1.93	20.17	4	04	02
	21	19	57	04.10	20	54	02.6	4.551 364	1.93	20.23	4	00	01
	22	19	56	58.73	20	54	27.3	4.537 989	1.94	20.29	3	56	00
	23	19	56	52.56	-20	54	54.3	4.524 767	1.94	20.35	3	51	58
	24	19	56	45.61	20	55	23.4	4.511 703	1.95	20.40	3	47	55
	25	19	56	37.87	20	55	54.7	4.498 800	1.95	20.46	3	43	51
	26	19	56	29.35	20	56	28.2	4.486 063	1.96	20.52	3	39	47
	27	19	56	20.06	20	57	03.9	4.473 498	1.97	20.58	3	35	41
	28	19	56	09.99	20	57	41.7	4.461 107	1.97	20.64	3	31	35
	29	19	55	59.15	-20	58	21.6	4.448 895	1.98	20.69	3	27	29
	30	19	55	47.54	20	59	03.6	4.436 866	1.98	20.75	3	23	21
	31	19	55	35.18	20	59	47.6	4.425 024	1.99	20.80	3	19	13
June	1	19	55	22.08	21	00	33.7	4.413 373	1.99	20.86	3	15	04
	2	19	55	08.23	21	01	21.7	4.401 916	2.00	20.91	3	10	54
	3	19	54	53.65	21	02	11.6	4.390 657	2.00	20.97	3	06	43
	4	19	54	38.36	-21	03	03.3	4.379 599	2.01	21.02	3	02	32
	5	19	54	22.35	21	03	57.0	4.368 746	2.01	21.07	2	58	20
	6	19	54	05.64	21	04	52.4	4.358 102	2.02	21.12	2	54	08
	7	19	53	48.23	21	05	49.7	4.347 668	2.02	21.17	2	49	54
	8	19	53	30.12	21	06	48.8	4.337 450	2.03	21.22	2	45	40
	9	19	53	11.33	21	07	49.5	4.327 451	2.03	21.27	2	41	26
	10	19	52	51.87	-21	08	52.0	4.317 675	2.04	21.32	2	37	10
	11	19	52	31.73	21	09	56.1	4.308 124	2.04	21.37	2	32	54
	12	19	52	10.94	21	11	01.8	4.298 804	2.05	21.42	2	28	38
	13	19	51	49.50	21	12	09.0	4.289 717	2.05	21.46	2	24	20
	14	19	51	27.42	21	13	17.7	4.280 868	2.05	21.50	2	20	02
	15	19	51	04.73	21	14	27.7	4.272 259	2.06	21.55	2	15	44
	16	19	50	41.43	-21	15	39.2	4.263 895	2.06	21.59	2	11	25
	17	19	50	17.54	21	16	51.9	4.255 778	2.07	21.63	2	07	05
	18	19	49	53.07	21	18	05.9	4.247 913	2.07	21.67	2	02	45
	19	19	49	28.04	21	19	21.0	4.240 302	2.07	21.71	1	58	24
	20	19	49	02.48	21	20	37.3	4.232 950	2.08	21.75	1	54	03
	21	19	48	36.38	21	21	54.7	4.225 858	2.08	21.78	1	49	41
	22	19	48	09.77	-21	23	13.1	4.219 030	2.08	21.82	1	45	18
	23	19	47	42.67	21	24	32.5	4.212 470	2.09	21.85	1	40	55
	24	19	47	15.09	21	25	52.8	4.206 178	2.09	21.89	1	36	32
	25	19	46	47.06	21	27	13.9	4.200 159	2.09	21.92	1	32	08
	26	19	46	18.58	21	28	35.8	4.194 413	2.10	21.95	1	27	44
	27	19	45	49.69	21	29	58.4	4.188 944	2.10	21.98	1	23	19
	28	19	45	20.39	-21	31	21.6	4.183 754	2.10	22.00	1	18	54
	29	19	44	50.72	21	32	45.4	4.178 843	2.10	22.03	1	14	29
	30	19	44	20.70	21	34	09.6	4.174 213	2.11	22.05	1	10	03
July	1	19	43	50.35	21	35	34.2	4.169 866	2.11	22.08	1	05	37
	2	19	43	19.69	-21	36	59.1	4.165 803	2.11	22.10	1	01	10

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RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension h	m	s	Apparent Declination °	'	"	True Distance from the Earth	Hor. Parallax "	Semi Diameter "	Ephemeris Transit h	m	s
July	1	19	43	50.35	-21	35	34.2	4.169 866	2.11	22.08	1	05	37
	2	19	43	19.69	21	36	59.1	4.165 803	2.11	22.10	1	01	10
	3	19	42	48.74	21	38	24.3	4.162 025	2.11	22.12	0	56	44
	4	19	42	17.52	21	39	49.8	4.158 534	2.11	22.14	0	52	17
	5	19	41	46.04	21	41	15.4	4.155 331	2.12	22.15	0	47	50
	6	19	41	14.34	21	42	41.2	4.152 416	2.12	22.17	0	43	22
	7	19	40	42.42	-21	44	07.0	4.149 791	2.12	22.18	0	38	55
	8	19	40	10.31	21	45	32.8	4.147 457	2.12	22.20	0	34	27
	9	19	39	38.03	21	46	58.6	4.145 415	2.12	22.21	0	29	59
	10	19	39	05.60	21	48	24.1	4.143 666	2.12	22.22	0	25	31
	11	19	38	33.04	21	49	49.5	4.142 211	2.12	22.22	0	21	02
	12	19	38	00.39	21	51	14.6	4.141 051	2.12	22.23	0	16	34
	13	19	37	27.65	-21	52	39.3	4.140 186	2.12	22.24	0	12	05
	14	19	36	54.86	21	54	03.6	4.139 617	2.12	22.24	0	07	37
	15	19	36	22.05	21	55	27.5	4.139 345	2.12	22.24	0	03	08
	16	19	35	49.23	21	56	50.8	4.139 369	2.12	22.24	23	54	11
	17	19	35	16.43	21	58	13.6	4.139 691	2.12	22.24	23	49	43
	18	19	34	43.68	21	59	35.8	4.140 309	2.12	22.24	23	45	14
	19	19	34	10.99	-22	00	57.3	4.141 225	2.12	22.23	23	40	46
	20	19	33	38.40	22	02	18.1	4.142 436	2.12	22.22	23	36	18
	21	19	33	05.93	22	03	38.2	4.143 944	2.12	22.22	23	31	50
	22	19	32	33.59	22	04	57.4	4.145 747	2.12	22.21	23	27	22
	23	19	32	01.42	22	06	15.8	4.147 845	2.12	22.19	23	22	54
	24	19	31	29.43	22	07	33.3	4.150 235	2.12	22.18	23	18	27
	25	19	30	57.66	-22	08	49.9	4.152 917	2.12	22.17	23	13	59
	26	19	30	26.12	22	10	05.3	4.155 889	2.12	22.15	23	09	32
	27	19	29	54.85	22	11	19.8	4.159 149	2.11	22.13	23	05	06
	28	19	29	23.87	22	12	33.1	4.162 695	2.11	22.12	23	00	39
	29	19	28	53.19	22	13	45.2	4.166 525	2.11	22.10	22	56	13
	30	19	28	22.85	22	14	56.2	4.170 638	2.11	22.07	22	51	47
	31	19	27	52.86	-22	16	06.0	4.175 030	2.11	22.05	22	47	22
Aug.	1	19	27	23.24	22	17	14.6	4.179 700	2.10	22.03	22	42	57
	2	19	26	54.00	22	18	22.0	4.184 645	2.10	22.00	22	38	32
	3	19	26	25.17	22	19	28.1	4.189 864	2.10	21.97	22	34	08
	4	19	25	56.76	22	20	32.9	4.195 354	2.10	21.94	22	29	45
	5	19	25	28.79	22	21	36.4	4.201 113	2.09	21.91	22	25	21
	6	19	25	01.28	-22	22	38.5	4.207 138	2.09	21.88	22	20	58
	7	19	24	34.25	22	23	39.3	4.213 428	2.09	21.85	22	16	36
	8	19	24	07.72	22	24	38.6	4.219 980	2.08	21.82	22	12	14
	9	19	23	41.70	22	25	36.5	4.226 791	2.08	21.78	22	07	53
	10	19	23	16.21	22	26	33.0	4.233 859	2.08	21.74	22	03	32
	11	19	22	51.28	22	27	28.0	4.241 182	2.07	21.71	21	59	12
	12	19	22	26.92	-22	28	21.5	4.248 756	2.07	21.67	21	54	53
	13	19	22	03.14	22	29	13.5	4.256 579	2.07	21.63	21	50	34
	14	19	21	39.97	22	30	04.0	4.264 647	2.06	21.59	21	46	15
	15	19	21	17.41	22	30	53.0	4.272 958	2.06	21.54	21	41	57
	16	19	20	55.49	-22	31	40.5	4.281 509	2.05	21.50	21	37	40

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RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Aug.	16	19	20	55.49	-22	31	40.5	4.281 509	2.05	21.50	21	37	40
	17	19	20	34.22	22	32	26.6	4.290 296	2.05	21.46	21	33	24
	18	19	20	13.60	22	33	11.0	4.299 315	2.05	21.41	21	29	08
	19	19	19	53.66	22	33	54.0	4.308 564	2.04	21.37	21	24	53
	20	19	19	34.40	22	34	35.4	4.318 038	2.04	21.32	21	20	38
	21	19	19	15.84	22	35	15.3	4.327 733	2.03	21.27	21	16	25
	22	19	18	58.00	-22	35	53.5	4.337 646	2.03	21.22	21	12	12
	23	19	18	40.88	22	36	30.2	4.347 771	2.02	21.17	21	07	59
	24	19	18	24.50	22	37	05.2	4.358 105	2.02	21.12	21	03	48
	25	19	18	08.88	22	37	38.7	4.368 643	2.01	21.07	20	59	37
	26	19	17	54.01	22	38	10.5	4.379 381	2.01	21.02	20	55	27
	27	19	17	39.90	22	38	40.8	4.390 315	2.00	20.97	20	51	18
	28	19	17	26.57	-22	39	09.6	4.401 440	2.00	20.92	20	47	09
	29	19	17	14.01	22	39	36.7	4.412 752	1.99	20.86	20	43	02
	30	19	17	02.23	22	40	02.3	4.424 248	1.99	20.81	20	38	55
	31	19	16	51.23	22	40	26.4	4.435 922	1.98	20.75	20	34	48
Sept.	1	19	16	41.03	22	40	48.8	4.447 771	1.98	20.70	20	30	43
	2	19	16	31.61	22	41	09.7	4.459 791	1.97	20.64	20	26	38
	3	19	16	23.00	-22	41	29.1	4.471 978	1.97	20.59	20	22	35
	4	19	16	15.18	22	41	46.8	4.484 328	1.96	20.53	20	18	32
	5	19	16	08.18	22	42	02.9	4.496 838	1.96	20.47	20	14	29
	6	19	16	01.99	22	42	17.5	4.509 502	1.95	20.41	20	10	28
	7	19	15	56.61	22	42	30.5	4.522 317	1.94	20.36	20	06	28
	8	19	15	52.06	22	42	41.9	4.535 280	1.94	20.30	20	02	28
	9	19	15	48.33	-22	42	51.7	4.548 385	1.93	20.24	19	58	29
	10	19	15	45.43	22	43	00.0	4.561 629	1.93	20.18	19	54	31
	11	19	15	43.35	22	43	06.7	4.575 008	1.92	20.12	19	50	33
	12	19	15	42.11	22	43	11.9	4.588 518	1.92	20.06	19	46	37
	13	19	15	41.69	22	43	15.6	4.602 154	1.91	20.00	19	42	41
	14	19	15	42.11	22	43	17.7	4.615 912	1.91	19.94	19	38	46
	15	19	15	43.36	-22	43	18.2	4.629 788	1.90	19.88	19	34	52
	16	19	15	45.44	22	43	17.3	4.643 777	1.89	19.82	19	30	59
	17	19	15	48.35	22	43	14.7	4.657 875	1.89	19.76	19	27	07
	18	19	15	52.09	22	43	10.6	4.672 076	1.88	19.70	19	23	15
	19	19	15	56.66	22	43	05.0	4.686 377	1.88	19.64	19	19	25
	20	19	16	02.07	22	42	57.7	4.700 772	1.87	19.58	19	15	35
	21	19	16	08.31	-22	42	48.9	4.715 256	1.87	19.52	19	11	46
	22	19	16	15.38	22	42	38.4	4.729 826	1.86	19.46	19	07	58
	23	19	16	23.28	22	42	26.5	4.744 475	1.85	19.40	19	04	10
	24	19	16	32.00	22	42	13.0	4.759 199	1.85	19.34	19	00	24
	25	19	16	41.53	22	41	57.9	4.773 995	1.84	19.28	18	56	38
	26	19	16	51.88	22	41	41.4	4.788 858	1.84	19.22	18	52	53
	27	19	17	03.02	-22	41	23.2	4.803 783	1.83	19.16	18	49	09
	28	19	17	14.96	22	41	03.6	4.818 767	1.82	19.10	18	45	25
	29	19	17	27.69	22	40	42.4	4.833 805	1.82	19.05	18	41	43
	30	19	17	41.21	22	40	19.6	4.848 893	1.81	18.99	18	38	01
Oct.	1	19	17	55.52	-22	39	55.2	4.864 029	1.81	18.93	18	34	20

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RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Oct.	1	19	17	55.52	-22	39	55.2	4.864 029	1.81	18.93	18	34	20
	2	19	18	10.60	22	39	29.3	4.879 207	1.80	18.87	18	30	39
	3	19	18	26.45	22	39	01.8	4.894 424	1.80	18.81	18	26	60
	4	19	18	43.08	22	38	32.7	4.909 676	1.79	18.75	18	23	21
	5	19	19	00.47	22	38	02.0	4.924 959	1.79	18.69	18	19	43
	6	19	19	18.63	22	37	29.7	4.940 270	1.78	18.63	18	16	06
	7	19	19	37.54	-22	36	55.8	4.955 605	1.77	18.58	18	12	29
	8	19	19	57.20	22	36	20.4	4.970 959	1.77	18.52	18	08	53
	9	19	20	17.61	22	35	43.3	4.986 330	1.76	18.46	18	05	18
	10	19	20	38.76	22	35	04.7	5.001 713	1.76	18.41	18	01	44
	11	19	21	00.63	22	34	24.5	5.017 105	1.75	18.35	17	58	11
	12	19	21	23.24	22	33	42.8	5.032 501	1.75	18.29	17	54	38
	13	19	21	46.56	-22	32	59.4	5.047 898	1.74	18.24	17	51	05
	14	19	22	10.59	22	32	14.4	5.063 291	1.74	18.18	17	47	34
	15	19	22	35.33	22	31	27.8	5.078 677	1.73	18.13	17	44	03
	16	19	23	00.78	22	30	39.5	5.094 052	1.73	18.07	17	40	33
	17	19	23	26.92	22	29	49.5	5.109 410	1.72	18.02	17	37	04
	18	19	23	53.75	22	28	57.9	5.124 748	1.72	17.96	17	33	35
	19	19	24	21.28	-22	28	04.6	5.140 063	1.71	17.91	17	30	07
	20	19	24	49.48	22	27	09.6	5.155 348	1.71	17.86	17	26	40
	21	19	25	18.36	22	26	13.0	5.170 602	1.70	17.80	17	23	13
	22	19	25	47.89	22	25	14.7	5.185 820	1.70	17.75	17	19	47
	23	19	26	18.07	22	24	14.8	5.200 997	1.69	17.70	17	16	21
	24	19	26	48.89	22	23	13.2	5.216 132	1.69	17.65	17	12	57
	25	19	27	20.34	-22	22	09.9	5.231 220	1.68	17.60	17	09	32
	26	19	27	52.41	22	21	05.0	5.246 258	1.68	17.55	17	06	09
	27	19	28	25.09	22	19	58.3	5.261 244	1.67	17.50	17	02	46
	28	19	28	58.38	22	18	49.9	5.276 172	1.67	17.45	16	59	24
	29	19	29	32.27	22	17	39.8	5.291 042	1.66	17.40	16	56	02
	30	19	30	06.75	22	16	28.0	5.305 849	1.66	17.35	16	52	41
	31	19	30	41.81	-22	15	14.4	5.320 591	1.65	17.30	16	49	20
Nov.	1	19	31	17.45	22	13	59.1	5.335 264	1.65	17.26	16	45	60
	2	19	31	53.67	22	12	42.0	5.349 866	1.64	17.21	16	42	40
	3	19	32	30.45	22	11	23.2	5.364 394	1.64	17.16	16	39	22
	4	19	33	07.78	22	10	02.7	5.378 845	1.63	17.12	16	36	03
	5	19	33	45.67	22	08	40.4	5.393 215	1.63	17.07	16	32	45
	6	19	34	24.10	-22	07	16.3	5.407 503	1.63	17.02	16	29	28
	7	19	35	03.05	22	05	50.5	5.421 704	1.62	16.98	16	26	11
	8	19	35	42.54	22	04	23.0	5.435 817	1.62	16.94	16	22	55
	9	19	36	22.54	22	02	53.7	5.449 837	1.61	16.89	16	19	39
	10	19	37	03.05	22	01	22.6	5.463 763	1.61	16.85	16	16	24
	11	19	37	44.06	21	59	49.7	5.477 590	1.61	16.81	16	13	09
	12	19	38	25.56	-21	58	15.0	5.491 316	1.60	16.76	16	09	55
	13	19	39	07.56	21	56	38.4	5.504 938	1.60	16.72	16	06	41
	14	19	39	50.05	21	55	00.1	5.518 451	1.59	16.68	16	03	28
	15	19	40	33.01	21	53	19.9	5.531 854	1.59	16.64	16	00	15
	16	19	41	16.44	-21	51	37.8	5.545 143	1.59	16.60	15	57	03

JUPITER, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Nov.	16	19	41	16.44	-21	51	37.8	5.545 143	1.59	16.60	15	57	03
	17	19	42	00.34	21	49	53.9	5.558 314	1.58	16.56	15	53	51
	18	19	42	44.69	21	48	08.3	5.571 365	1.58	16.52	15	50	39
	19	19	43	29.48	21	46	20.8	5.584 293	1.57	16.49	15	47	28
	20	19	44	14.70	21	44	31.5	5.597 095	1.57	16.45	15	44	17
	21	19	45	00.35	21	42	40.4	5.609 769	1.57	16.41	15	41	07
	22	19	45	46.40	-21	40	47.5	5.622 312	1.56	16.37	15	37	57
	23	19	46	32.85	21	38	52.7	5.634 723	1.56	16.34	15	34	48
	24	19	47	19.71	21	36	56.1	5.646 998	1.56	16.30	15	31	39
	25	19	48	06.95	21	34	57.7	5.659 137	1.55	16.27	15	28	30
	26	19	48	54.57	21	32	57.4	5.671 136	1.55	16.23	15	25	22
	27	19	49	42.57	21	30	55.3	5.682 993	1.55	16.20	15	22	14
	28	19	50	30.93	-21	28	51.3	5.694 708	1.54	16.17	15	19	07
	29	19	51	19.66	21	26	45.4	5.706 277	1.54	16.13	15	15	59
	30	19	52	08.75	21	24	37.8	5.717 699	1.54	16.10	15	12	52
Dec.	1	19	52	58.18	21	22	28.3	5.728 972	1.54	16.07	15	09	46
	2	19	53	47.96	21	20	16.9	5.740 093	1.53	16.04	15	06	40
	3	19	54	38.06	21	18	03.8	5.751 062	1.53	16.01	15	03	34
	4	19	55	28.50	-21	15	48.8	5.761 876	1.53	15.98	15	00	28
	5	19	56	19.25	21	13	32.0	5.772 532	1.52	15.95	14	57	23
	6	19	57	10.31	21	11	13.5	5.783 030	1.52	15.92	14	54	18
	7	19	58	01.67	21	08	53.1	5.793 367	1.52	15.89	14	51	14
	8	19	58	53.33	21	06	30.9	5.803 542	1.52	15.86	14	48	09
	9	19	59	45.28	21	04	06.8	5.813 551	1.51	15.84	14	45	05
	10	20	00	37.51	-21	01	40.9	5.823 392	1.51	15.81	14	42	02
	11	20	01	30.03	20	59	13.2	5.833 065	1.51	15.78	14	38	58
	12	20	02	22.82	20	56	43.6	5.842 566	1.51	15.76	14	35	55
	13	20	03	15.89	20	54	12.2	5.851 893	1.50	15.73	14	32	52
	14	20	04	09.21	20	51	39.0	5.861 044	1.50	15.71	14	29	49
	15	20	05	02.79	20	49	04.0	5.870 017	1.50	15.68	14	26	47
	16	20	05	56.62	-20	46	27.2	5.878 810	1.50	15.66	14	23	45
	17	20	06	50.67	20	43	48.7	5.887 422	1.49	15.64	14	20	43
	18	20	07	44.95	20	41	08.4	5.895 851	1.49	15.61	14	17	41
	19	20	08	39.45	20	38	26.4	5.904 095	1.49	15.59	14	14	39
	20	20	09	34.15	20	35	42.7	5.912 154	1.49	15.57	14	11	38
	21	20	10	29.06	20	32	57.2	5.920 025	1.49	15.55	14	08	37
	22	20	11	24.16	-20	30	09.9	5.927 708	1.48	15.53	14	05	36
	23	20	12	19.45	20	27	20.9	5.935 202	1.48	15.51	14	02	35
	24	20	13	14.92	20	24	30.2	5.942 505	1.48	15.49	13	59	34
	25	20	14	10.57	20	21	37.8	5.949 617	1.48	15.47	13	56	34
	26	20	15	06.39	20	18	43.7	5.956 537	1.48	15.46	13	53	34
	27	20	16	02.38	20	15	48.0	5.963 263	1.47	15.44	13	50	34
	28	20	16	58.53	-20	12	50.5	5.969 796	1.47	15.42	13	47	34
	29	20	17	54.83	20	09	51.4	5.976 133	1.47	15.40	13	44	34
	30	20	18	51.28	20	06	50.7	5.982 275	1.47	15.39	13	41	34
	31	20	19	47.86	20	03	48.4	5.988 220	1.47	15.37	13	38	35
	32	20	20	44.58	-20	00	44.5	5.993 967	1.47	15.36	13	35	35

SATURN, 2020

HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Heliocentric Longitude			Heliocentric Latitude			Radius Vector	Date	Heliocentric Longitude			Heliocentric Latitude			Radius Vector
	°	'	"	°	'	"			°	'	"	°	'	"	
Jan. 1	292	30	56.0	+0	03	24.0	10.034 334	Apr. 2	295	18	12.1	-0	03	51.1	10.024 425
3	292	34	34.0	0	03	14.6	10.034 133	4	295	21	50.5	0	04	00.5	10.024 194
5	292	38	11.9	0	03	05.1	10.033 931	6	295	25	28.9	0	04	10.0	10.023 963
7	292	41	49.9	0	02	55.7	10.033 729	8	295	29	07.3	0	04	19.5	10.023 732
9	292	45	27.9	0	02	46.2	10.033 526	10	295	32	45.8	0	04	28.9	10.023 500
11	292	49	05.9	0	02	36.8	10.033 322	12	295	36	24.2	0	04	38.4	10.023 267
13	292	52	44.0	+0	02	27.3	10.033 118	14	295	40	02.6	-0	04	47.9	10.023 034
15	292	56	22.0	0	02	17.9	10.032 913	16	295	43	41.1	0	04	57.3	10.022 800
17	292	59	60.0	0	02	08.4	10.032 707	18	295	47	19.6	0	05	06.8	10.022 565
19	293	03	38.0	0	01	58.9	10.032 501	20	295	50	58.1	0	05	16.3	10.022 330
21	293	07	16.1	0	01	49.5	10.032 294	22	295	54	36.6	0	05	25.7	10.022 094
23	293	10	54.1	0	01	40.0	10.032 086	24	295	58	15.1	0	05	35.2	10.021 857
25	293	14	32.2	+0	01	30.6	10.031 878	26	296	01	53.6	-0	05	44.6	10.021 620
27	293	18	10.3	0	01	21.1	10.031 669	28	296	05	32.1	0	05	54.1	10.021 382
29	293	21	48.4	0	01	11.7	10.031 460	30	296	09	10.7	0	06	03.6	10.021 144
31	293	25	26.5	0	01	02.2	10.031 250	May 2	296	12	49.2	0	06	13.0	10.020 904
Feb. 2	293	29	04.6	0	00	52.8	10.031 039	4	296	16	27.7	0	06	22.5	10.020 665
4	293	32	42.7	0	00	43.3	10.030 828	6	296	20	06.3	0	06	32.0	10.020 424
6	293	36	20.8	+0	00	33.9	10.030 616	8	296	23	44.9	-0	06	41.4	10.020 183
8	293	39	58.9	0	00	24.4	10.030 403	10	296	27	23.5	0	06	50.9	10.019 942
10	293	43	37.1	0	00	15.0	10.030 190	12	296	31	02.1	0	07	00.4	10.019 699
12	293	47	15.2	+0	00	05.5	10.029 976	14	296	34	40.7	0	07	09.8	10.019 456
14	293	50	53.4	-0	00	04.0	10.029 762	16	296	38	19.3	0	07	19.3	10.019 213
16	293	54	31.6	0	00	13.4	10.029 546	18	296	41	57.9	0	07	28.8	10.018 969
18	293	58	09.7	-0	00	22.9	10.029 331	20	296	45	36.6	-0	07	38.3	10.018 724
20	294	01	47.9	0	00	32.3	10.029 114	22	296	49	15.2	0	07	47.7	10.018 478
22	294	05	26.1	0	00	41.8	10.028 897	24	296	52	53.9	0	07	57.2	10.018 232
24	294	09	04.3	0	00	51.3	10.028 680	26	296	56	32.6	0	08	06.7	10.017 986
26	294	12	42.6	0	01	00.7	10.028 461	28	297	00	11.3	0	08	16.1	10.017 738
28	294	16	20.8	0	01	10.2	10.028 242	30	297	03	50.0	0	08	25.6	10.017 490
Mar. 1	294	19	59.0	-0	01	19.7	10.028 023	June 1	297	07	28.7	-0	08	35.1	10.017 242
3	294	23	37.2	0	01	29.1	10.027 803	3	297	11	07.4	0	08	44.5	10.016 992
5	294	27	15.5	0	01	38.6	10.027 582	5	297	14	46.1	0	08	54.0	10.016 742
7	294	30	53.8	0	01	48.0	10.027 361	7	297	18	24.9	0	09	03.4	10.016 492
9	294	34	32.0	0	01	57.5	10.027 138	9	297	22	03.7	0	09	12.9	10.016 241
11	294	38	10.3	0	02	06.9	10.026 916	11	297	25	42.4	0	09	22.4	10.015 989
13	294	41	48.6	-0	02	16.4	10.026 692	13	297	29	21.2	-0	09	31.8	10.015 736
15	294	45	26.9	0	02	25.9	10.026 469	15	297	32	60.0	0	09	41.3	10.015 483
17	294	49	05.2	0	02	35.3	10.026 244	17	297	36	38.8	0	09	50.8	10.015 230
19	294	52	43.5	0	02	44.8	10.026 019	19	297	40	17.6	0	10	00.2	10.014 975
21	294	56	21.9	0	02	54.3	10.025 793	21	297	43	56.4	0	10	09.7	10.014 720
23	295	00	00.2	0	03	03.7	10.025 566	23	297	47	35.2	0	10	19.2	10.014 465
25	295	03	38.6	-0	03	13.2	10.025 339	25	297	51	14.1	-0	10	28.6	10.014 208
27	295	07	16.9	0	03	22.7	10.025 112	27	297	54	52.9	0	10	38.1	10.013 951
29	295	10	55.3	0	03	32.1	10.024 883	29	297	58	31.8	0	10	47.6	10.013 694
31	295	14	33.7	0	03	41.6	10.024 654	July 1	298	02	10.7	0	10	57.0	10.013 436
Apr. 2	295	18	12.1	-0	03	51.1	10.024 425	3	298	05	49.6	-0	11	06.5	10.013 177

SATURN, 2020

HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude			Heliocentric Latitude			Radius Vector	Date		Heliocentric Longitude			Heliocentric Latitude			Radius Vector
		°	'	"	°	'	"				°	'	"	°	'	"	
July	1	298	02	10.7	-0	10	57.0	10.013 436	Oct.	1	300	50	11.7	-0	18	11.9	10.000 876
	3	298	05	49.6	0	11	06.5	10.013 177		3	300	53	51.2	0	18	21.3	10.000 588
	5	298	09	28.5	0	11	16.0	10.012 917		5	300	57	30.6	0	18	30.8	10.000 300
	7	298	13	07.4	0	11	25.4	10.012 657		7	301	01	10.0	0	18	40.2	10.000 011
	9	298	16	46.3	0	11	34.9	10.012 396		9	301	04	49.5	0	18	49.7	9.999 721
	11	298	20	25.2	0	11	44.3	10.012 135		11	301	08	29.0	0	18	59.1	9.999 431
	13	298	24	04.2	-0	11	53.8	10.011 873		13	301	12	08.5	-0	19	08.6	9.999 141
	15	298	27	43.1	0	12	03.3	10.011 610		15	301	15	48.0	0	19	18.0	9.998 849
	17	298	31	22.1	0	12	12.7	10.011 347		17	301	19	27.5	0	19	27.4	9.998 557
	19	298	35	01.1	0	12	22.2	10.011 083		19	301	23	07.1	0	19	36.9	9.998 265
	21	298	38	40.1	0	12	31.6	10.010 819		21	301	26	46.7	0	19	46.3	9.997 971
	23	298	42	19.1	0	12	41.1	10.010 553		23	301	30	26.2	0	19	55.7	9.997 678
	25	298	45	58.1	-0	12	50.6	10.010 288		25	301	34	05.8	-0	20	05.2	9.997 383
	27	298	49	37.1	0	13	00.0	10.010 021		27	301	37	45.4	0	20	14.6	9.997 088
	29	298	53	16.2	0	13	09.5	10.009 754		29	301	41	25.0	0	20	24.0	9.996 793
	31	298	56	55.2	0	13	19.0	10.009 486		31	301	45	04.6	0	20	33.4	9.996 496
Aug.	2	299	00	34.3	0	13	28.4	10.009 218	Nov.	2	301	48	44.2	0	20	42.9	9.996 199
	4	299	04	13.4	0	13	37.8	10.008 949		4	301	52	23.9	0	20	52.3	9.995 902
	6	299	07	52.4	-0	13	47.3	10.008 679		6	301	56	03.5	-0	21	01.7	9.995 604
	8	299	11	31.6	0	13	56.8	10.008 409		8	301	59	43.2	0	21	11.2	9.995 305
	10	299	15	10.6	0	14	06.2	10.008 138		10	302	03	22.9	0	21	20.6	9.995 006
	12	299	18	49.8	0	14	15.7	10.007 867		12	302	07	02.6	0	21	30.0	9.994 706
	14	299	22	28.9	0	14	25.1	10.007 595		14	302	10	42.3	0	21	39.4	9.994 406
	16	299	26	08.0	0	14	34.6	10.007 322		16	302	14	22.0	0	21	48.9	9.994 104
	18	299	29	47.2	-0	14	44.1	10.007 048		18	302	18	01.7	-0	21	58.3	9.993 803
	20	299	33	26.4	0	14	53.5	10.006 774		20	302	21	41.5	0	22	07.7	9.993 500
	22	299	37	05.5	0	15	03.0	10.006 500		22	302	25	21.2	0	22	17.1	9.993 198
	24	299	40	44.7	0	15	12.4	10.006 224		24	302	29	01.0	0	22	26.5	9.992 894
	26	299	44	24.0	0	15	21.8	10.005 949		26	302	32	40.8	0	22	36.0	9.992 590
	28	299	48	03.1	0	15	31.3	10.005 672		28	302	36	20.6	0	22	45.4	9.992 285
	30	299	51	42.4	-0	15	40.8	10.005 395		30	302	40	00.4	-0	22	54.8	9.991 980
Sept.	1	299	55	21.6	0	15	50.2	10.005 117	Dec.	2	302	43	40.3	0	23	04.2	9.991 674
	3	299	59	00.9	0	15	59.7	10.004 839		4	302	47	20.1	0	23	13.6	9.991 368
	5	300	02	40.1	0	16	09.1	10.004 560		6	302	50	60.0	0	23	23.0	9.991 060
	7	300	06	19.4	0	16	18.6	10.004 280		8	302	54	39.9	0	23	32.5	9.990 753
	9	300	09	58.7	0	16	28.0	10.004 000		10	302	58	19.7	0	23	41.9	9.990 444
	11	300	13	38.0	-0	16	37.5	10.003 719		12	303	01	59.6	-0	23	51.3	9.990 135
	13	300	17	17.3	0	16	46.9	10.003 437		14	303	05	39.5	0	24	00.7	9.989 826
	15	300	20	56.7	0	16	56.3	10.003 155		16	303	09	19.5	0	24	10.1	9.989 516
	17	300	24	36.0	0	17	05.8	10.002 872		18	303	12	59.4	0	24	19.5	9.989 205
	19	300	28	15.3	0	17	15.2	10.002 589		20	303	16	39.4	0	24	28.9	9.988 894
	21	300	31	54.7	0	17	24.7	10.002 305		22	303	20	19.3	0	24	38.3	9.988 582
	23	300	35	34.1	-0	17	34.1	10.002 021		24	303	23	59.3	-0	24	47.7	9.988 269
	25	300	39	13.5	0	17	43.6	10.001 735		26	303	27	39.3	0	24	57.1	9.987 956
	27	300	42	52.9	0	17	53.0	10.001 449		28	303	31	19.3	0	25	06.5	9.987 642
	29	300	46	32.3	0	18	02.5	10.001 163		30	303	34	59.4	0	25	15.9	9.987 328
Oct.	1	300	50	11.7	-0	18	11.9	10.000 876		32	303	38	39.4	-0	25	25.3	9.987 013

SATURN, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Jan.	0	291	16	40.9	+0	03	10.8	Feb.	15	296	36	53.6	-0	00	07.7
	1	291	23	41.6	0	03	06.4		16	296	43	23.4	0	00	12.1
	2	291	30	43.1	0	03	02.0		17	296	49	51.1	0	00	16.4
	3	291	37	45.4	0	02	57.7		18	296	56	16.4	0	00	20.8
	4	291	44	48.4	0	02	53.3		19	297	02	39.3	0	00	25.2
	5	291	51	52.1	0	02	49.0		20	297	08	59.8	0	00	29.6
	6	291	58	56.4	+0	02	44.6		21	297	15	17.7	-0	00	34.1
	7	292	06	01.3	0	02	40.3		22	297	21	33.0	0	00	38.5
	8	292	13	06.6	0	02	36.0		23	297	27	45.6	0	00	42.9
	9	292	20	12.4	0	02	31.7		24	297	33	55.3	0	00	47.4
	10	292	27	18.6	0	02	27.4		25	297	40	02.3	0	00	51.8
	11	292	34	25.0	0	02	23.1		26	297	46	06.3	0	00	56.3
	12	292	41	31.7	+0	02	18.8		27	297	52	07.3	-0	01	00.7
	13	292	48	38.8	0	02	14.5		28	297	58	05.4	0	01	05.2
	14	292	55	43.3	0	02	10.3		29	298	04	00.4	0	01	09.7
	15	293	02	50.9	0	02	05.9	Mar.	1	298	09	52.3	0	01	14.1
	16	293	09	57.5	0	02	01.6		2	298	15	41.0	0	01	18.6
	17	293	17	03.9	0	01	57.3		3	298	21	26.5	0	01	23.1
	18	293	24	10.2	+0	01	53.0		4	298	27	08.7	-0	01	27.7
	19	293	31	16.2	0	01	48.7		5	298	32	47.6	0	01	32.2
	20	293	38	21.9	0	01	44.4		6	298	38	23.0	0	01	36.7
	21	293	45	27.2	0	01	40.1		7	298	43	54.9	0	01	41.3
	22	293	52	32.1	0	01	35.8		8	298	49	23.2	0	01	45.8
	23	293	59	36.4	0	01	31.5		9	298	54	47.8	0	01	50.4
	24	294	06	40.1	+0	01	27.2		10	299	00	08.7	-0	01	55.0
	25	294	13	43.1	0	01	22.9		11	299	05	25.9	0	01	59.6
	26	294	20	45.2	0	01	18.6		12	299	10	39.3	0	02	04.2
	27	294	27	46.4	0	01	14.3		13	299	15	49.0	0	02	08.9
	28	294	34	46.6	0	01	10.0		14	299	20	54.9	0	02	13.5
	29	294	41	45.8	0	01	05.7		15	299	25	56.8	0	02	18.2
	30	294	48	43.9	+0	01	01.4		16	299	30	54.8	-0	02	22.9
	31	294	55	40.9	0	00	57.1		17	299	35	48.8	0	02	27.6
Feb.	1	295	02	36.7	0	00	52.8		18	299	40	38.6	0	02	32.3
	2	295	09	31.1	0	00	48.5		19	299	45	24.2	0	02	37.1
	3	295	16	24.3	0	00	44.2		20	299	50	05.5	0	02	41.8
	4	295	23	16.1	0	00	39.9		21	299	54	42.5	0	02	46.6
	5	295	30	06.4	+0	00	35.6		22	299	59	15.1	-0	02	51.3
	6	295	36	55.3	0	00	31.3		23	300	03	43.2	0	02	56.1
	7	295	43	42.5	0	00	27.0		24	300	08	06.8	0	03	00.9
	8	295	50	28.0	0	00	22.7		25	300	12	25.8	0	03	05.7
	9	295	57	11.8	0	00	18.4		26	300	16	40.3	0	03	10.6
	10	296	03	53.6	0	00	14.1		27	300	20	50.1	0	03	15.4
	11	296	10	33.6	+0	00	09.7		28	300	24	55.2	-0	03	20.3
	12	296	17	11.6	0	00	05.4		29	300	28	55.7	0	03	25.1
	13	296	23	47.7	+0	00	01.0		30	300	32	51.3	0	03	30.0
	14	296	30	21.7	-0	00	03.3		31	300	36	42.2	0	03	34.9
	15	296	36	53.6	-0	00	07.7	Apr.	1	300	40	28.2	-0	03	39.9

SATURN, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"	Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
Apr.	1	300	40	28.2	-0	03	39.9	May	17	301	55	45.1	-0	07	45.3
	2	300	44	09.3	0	03	44.8		18	301	55	08.0	0	07	51.0
	3	300	47	45.3	0	03	49.7		19	301	54	25.0	0	07	56.7
	4	300	51	16.4	0	03	54.7		20	301	53	36.4	0	08	02.5
	5	300	54	42.3	0	03	59.7		21	301	52	42.0	0	08	08.2
	6	300	58	03.1	0	04	04.7		22	301	51	42.0	0	08	13.9
	7	301	01	18.8	-0	04	09.7		23	301	50	36.3	-0	08	19.7
	8	301	04	29.2	0	04	14.8		24	301	49	24.9	0	08	25.4
	9	301	07	34.6	0	04	19.9		25	301	48	08.0	0	08	31.2
	10	301	10	34.7	0	04	25.0		26	301	46	45.6	0	08	37.0
	11	301	13	29.7	0	04	30.1		27	301	45	17.6	0	08	42.8
	12	301	16	19.4	0	04	35.2		28	301	43	44.1	0	08	48.5
	13	301	19	03.7	-0	04	40.4		29	301	42	05.1	-0	08	54.3
	14	301	21	42.7	0	04	45.5		30	301	40	20.7	0	09	00.2
	15	301	24	16.2	0	04	50.7		31	301	38	30.9	0	09	06.0
	16	301	26	44.2	0	04	55.9	June	1	301	36	35.9	0	09	11.8
	17	301	29	06.6	0	05	01.1		2	301	34	35.6	0	09	17.6
	18	301	31	23.4	0	05	06.4		3	301	32	30.3	0	09	23.5
	19	301	33	34.6	-0	05	11.6		4	301	30	19.9	-0	09	29.3
	20	301	35	40.2	0	05	16.9		5	301	28	04.6	0	09	35.2
	21	301	37	40.1	0	05	22.2		6	301	25	44.3	0	09	41.1
	22	301	39	34.3	0	05	27.5		7	301	23	19.2	0	09	46.9
	23	301	41	22.8	0	05	32.8		8	301	20	49.2	0	09	52.8
	24	301	43	05.6	0	05	38.1		9	301	18	14.4	0	09	58.7
	25	301	44	42.7	-0	05	43.5		10	301	15	34.8	-0	10	04.5
	26	301	46	14.0	0	05	48.8		11	301	12	50.5	0	10	10.4
	27	301	47	39.6	0	05	54.2		12	301	10	01.6	0	10	16.3
	28	301	48	59.4	0	05	59.6		13	301	07	08.1	0	10	22.1
	29	301	50	13.4	0	06	05.0		14	301	04	10.1	0	10	28.0
	30	301	51	21.5	0	06	10.4		15	301	01	07.8	0	10	33.8
May	1	301	52	23.8	-0	06	15.9		16	300	58	01.3	-0	10	39.7
	2	301	53	20.2	0	06	21.3		17	300	54	50.5	0	10	45.5
	3	301	54	10.7	0	06	26.8		18	300	51	35.7	0	10	51.3
	4	301	54	55.3	0	06	32.3		19	300	48	16.9	0	10	57.1
	5	301	55	34.0	0	06	37.8		20	300	44	54.3	0	11	02.9
	6	301	56	07.0	0	06	43.4		21	300	41	27.9	0	11	08.7
	7	301	56	34.1	-0	06	48.9		22	300	37	57.7	-0	11	14.5
	8	301	56	55.5	0	06	54.5		23	300	34	24.0	0	11	20.3
	9	301	57	11.1	0	07	00.1		24	300	30	46.8	0	11	26.1
	10	301	57	20.8	0	07	05.7		25	300	27	06.1	0	11	31.9
	11	301	57	24.8	0	07	11.3		26	300	23	22.2	0	11	37.6
	12	301	57	22.9	0	07	17.0		27	300	19	35.0	0	11	43.4
	13	301	57	15.1	-0	07	22.6		28	300	15	44.8	-0	11	49.1
	14	301	57	01.4	0	07	28.3		29	300	11	51.7	0	11	54.8
	15	301	56	41.8	0	07	33.9		30	300	07	55.8	0	12	00.6
	16	301	56	16.4	0	07	39.6	July	1	300	03	57.3	0	12	06.3
	17	301	55	45.1	-0	07	45.3		2	299	59	56.3	-0	12	12.0

SATURN, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"	Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
July	1	300	03	57.3	-0	12	06.3	Aug.	16	296	49	16.2	-0	16	02.3
	2	299	59	56.3	0	12	12.0		17	296	45	35.9	0	16	06.7
	3	299	55	53.0	0	12	17.7		18	296	41	59.0	0	16	11.0
	4	299	51	47.3	0	12	23.3		19	296	38	25.5	0	16	15.3
	5	299	47	39.4	0	12	29.0		20	296	34	55.6	0	16	19.6
	6	299	43	29.5	0	12	34.6		21	296	31	29.4	0	16	23.9
	7	299	39	17.5	-0	12	40.2		22	296	28	07.1	-0	16	28.1
	8	299	35	03.6	0	12	45.8		23	296	24	48.7	0	16	32.2
	9	299	30	47.9	0	12	51.4		24	296	21	34.5	0	16	36.4
	10	299	26	30.6	0	12	56.9		25	296	18	24.4	0	16	40.5
	11	299	22	11.7	0	13	02.5		26	296	15	18.7	0	16	44.6
	12	299	17	51.5	0	13	08.0		27	296	12	17.3	0	16	48.6
	13	299	13	30.0	-0	13	13.4		28	296	09	20.4	-0	16	52.6
	14	299	09	07.4	0	13	18.9		29	296	06	27.9	0	16	56.6
	15	299	04	43.9	0	13	24.3		30	296	03	40.1	0	17	00.6
	16	299	00	19.6	0	13	29.7		31	296	00	56.8	0	17	04.5
	17	298	55	54.6	0	13	35.1	Sept.	1	295	58	18.1	0	17	08.3
	18	298	51	29.1	0	13	40.4		2	295	55	44.2	0	17	12.2
	19	298	47	03.2	-0	13	45.7		3	295	53	15.2	-0	17	16.0
	20	298	42	37.0	0	13	51.0		4	295	50	51.0	0	17	19.7
	21	298	38	10.7	0	13	56.3		5	295	48	31.8	0	17	23.5
	22	298	33	44.3	0	14	01.5		6	295	46	17.6	0	17	27.1
	23	298	29	18.0	0	14	06.7		7	295	44	08.6	0	17	30.8
	24	298	24	51.9	0	14	11.9		8	295	42	04.8	0	17	34.4
	25	298	20	26.2	-0	14	17.0		9	295	40	06.3	-0	17	38.0
	26	298	16	01.1	0	14	22.2		10	295	38	13.1	0	17	41.6
	27	298	11	36.7	0	14	27.3		11	295	36	25.3	0	17	45.1
	28	298	07	13.3	0	14	32.3		12	295	34	43.0	0	17	48.6
	29	298	02	50.8	0	14	37.4		13	295	33	06.1	0	17	52.1
	30	297	58	29.5	0	14	42.4		14	295	31	34.7	0	17	55.5
	31	297	54	09.5	-0	14	47.4		15	295	30	08.8	-0	17	58.9
Aug.	1	297	49	50.9	0	14	52.3		16	295	28	48.5	0	18	02.3
	2	297	45	33.8	0	14	57.3		17	295	27	33.9	0	18	05.7
	3	297	41	18.2	0	15	02.1		18	295	26	24.9	0	18	09.0
	4	297	37	04.4	0	15	07.0		19	295	25	21.7	0	18	12.3
	5	297	32	52.3	0	15	11.8		20	295	24	24.4	0	18	15.6
	6	297	28	42.2	-0	15	16.6		21	295	23	32.9	-0	18	18.9
	7	297	24	34.1	0	15	21.3		22	295	22	47.3	0	18	22.1
	8	297	20	28.2	0	15	26.0		23	295	22	07.7	0	18	25.3
	9	297	16	24.7	0	15	30.7		24	295	21	34.0	0	18	28.5
	10	297	12	23.6	0	15	35.3		25	295	21	06.2	0	18	31.7
	11	297	08	25.2	0	15	39.9		26	295	20	44.3	0	18	34.8
	12	297	04	29.4	-0	15	44.5		27	295	20	28.2	-0	18	38.0
	13	297	00	36.6	0	15	49.0		28	295	20	18.1	0	18	41.1
	14	296	56	46.7	0	15	53.5		29	295	20	13.9	0	18	44.1
	15	296	52	59.9	0	15	57.9		30	295	20	15.6	0	18	47.2
	16	296	49	16.2	-0	16	02.3	Oct.	1	295	20	23.2	-0	18	50.2

SATURN, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Oct.	1	295	20	23.2	-0	18	50.2	Nov.	16	297	10	04.2	-0	20	57.3
	2	295	20	36.7	0	18	53.2		17	297	14	31.2	0	21	00.0
	3	295	20	56.2	0	18	56.2		18	297	19	02.9	0	21	02.8
	4	295	21	21.7	0	18	59.2		19	297	23	39.0	0	21	05.5
	5	295	21	53.2	0	19	02.1		20	297	28	19.6	0	21	08.3
	6	295	22	30.7	0	19	05.0		21	297	33	04.4	0	21	11.0
	7	295	23	14.2	-0	19	07.9		22	297	37	53.5	-0	21	13.8
	8	295	24	03.7	0	19	10.8		23	297	42	46.8	0	21	16.6
	9	295	24	59.1	0	19	13.7		24	297	47	44.3	0	21	19.4
	10	295	26	00.5	0	19	16.5		25	297	52	45.8	0	21	22.2
	11	295	27	07.9	0	19	19.4		26	297	57	51.4	0	21	25.0
	12	295	28	21.1	0	19	22.2		27	298	03	01.0	0	21	27.8
	13	295	29	40.3	-0	19	25.0		28	298	08	14.5	-0	21	30.6
	14	295	31	05.3	0	19	27.8		29	298	13	32.0	0	21	33.4
	15	295	32	36.2	0	19	30.6		30	298	18	53.3	0	21	36.3
	16	295	34	13.0	0	19	33.4	Dec.	1	298	24	18.3	0	21	39.1
	17	295	35	55.7	0	19	36.2		2	298	29	47.1	0	21	42.0
	18	295	37	44.4	0	19	39.0		3	298	35	19.5	0	21	44.9
	19	295	39	38.9	-0	19	41.8		4	298	40	55.5	-0	21	47.8
	20	295	41	39.3	0	19	44.5		5	298	46	35.0	0	21	50.7
	21	295	43	45.6	0	19	47.3		6	298	52	17.8	0	21	53.7
	22	295	45	57.6	0	19	50.0		7	298	58	04.1	0	21	56.6
	23	295	48	15.2	0	19	52.7		8	299	03	53.6	0	21	59.6
	24	295	50	38.6	0	19	55.5		9	299	09	46.4	0	22	02.6
	25	295	53	07.4	-0	19	58.2		10	299	15	42.3	-0	22	05.6
	26	295	55	41.9	0	20	00.9		11	299	21	41.5	0	22	08.7
	27	295	58	21.8	0	20	03.6		12	299	27	43.7	0	22	11.7
	28	296	01	07.2	0	20	06.3		13	299	33	49.1	0	22	14.8
	29	296	03	58.1	0	20	09.0		14	299	39	57.5	0	22	17.9
	30	296	06	54.4	0	20	11.7		15	299	46	08.8	0	22	21.0
	31	296	09	56.1	-0	20	14.3		16	299	52	23.0	-0	22	24.2
Nov.	1	296	13	03.2	0	20	17.0		17	299	58	39.8	0	22	27.3
	2	296	16	15.7	0	20	19.7		18	300	04	59.2	0	22	30.5
	3	296	19	33.4	0	20	22.3		19	300	11	21.2	0	22	33.7
	4	296	22	56.4	0	20	25.0		20	300	17	45.6	0	22	36.9
	5	296	26	24.6	0	20	27.7		21	300	24	12.5	0	22	40.2
	6	296	29	58.0	-0	20	30.3		22	300	30	41.6	-0	22	43.5
	7	296	33	36.5	0	20	33.0		23	300	37	13.0	0	22	46.7
	8	296	37	20.0	0	20	35.7		24	300	43	46.7	0	22	50.0
	9	296	41	08.4	0	20	38.4		25	300	50	22.5	0	22	53.4
	10	296	45	01.8	0	20	41.0		26	300	57	00.5	0	22	56.7
	11	296	49	00.1	0	20	43.7		27	301	03	40.5	0	23	00.1
	12	296	53	03.3	-0	20	46.4		28	301	10	22.5	-0	23	03.5
	13	296	57	11.3	0	20	49.1		29	301	17	06.4	0	23	06.9
	14	297	01	24.1	0	20	51.8		30	301	23	52.1	0	23	10.4
	15	297	05	41.8	0	20	54.6		31	301	30	39.6	0	23	13.9
	16	297	10	04.2	-0	20	57.3		32	301	37	28.7	-0	23	17.4

SATURN, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Jan.	0	19	31	57.68	-21	42	04.3	10.993 032	0.80	6.72	12	53	35
	1	19	32	27.54	21	41	03.1	10.996 391	0.80	6.71	12	50	09
	2	19	32	57.46	21	40	01.5	10.999 491	0.80	6.71	12	46	43
	3	19	33	27.42	21	38	59.3	11.002 334	0.80	6.71	12	43	17
	4	19	33	57.43	21	37	56.8	11.004 917	0.80	6.71	12	39	51
	5	19	34	27.48	21	36	53.7	11.007 241	0.80	6.71	12	36	25
	6	19	34	57.56	-21	35	50.2	11.009 306	0.80	6.71	12	32	59
	7	19	35	27.68	21	34	46.2	11.011 111	0.80	6.70	12	29	33
	8	19	35	57.82	21	33	41.9	11.012 657	0.80	6.70	12	26	07
	9	19	36	27.99	21	32	37.1	11.013 943	0.80	6.70	12	22	41
	10	19	36	58.17	21	31	31.9	11.014 969	0.80	6.70	12	19	15
	11	19	37	28.37	21	30	26.4	11.015 735	0.80	6.70	12	15	49
	12	19	37	58.58	-21	29	20.5	11.016 242	0.80	6.70	12	12	23
	13	19	38	28.80	21	28	14.2	11.016 488	0.80	6.70	12	08	57
	14	19	38	58.84	21	27	07.8	11.016 474	0.80	6.70	12	05	31
	15	19	39	29.09	21	26	00.9	11.016 200	0.80	6.70	12	02	06
	16	19	39	59.26	21	24	53.7	11.015 665	0.80	6.70	11	58	40
	17	19	40	29.42	21	23	46.1	11.014 869	0.80	6.70	11	55	14
	18	19	40	59.54	-21	22	38.2	11.013 811	0.80	6.70	11	51	48
	19	19	41	29.65	21	21	29.9	11.012 493	0.80	6.70	11	48	22
	20	19	41	59.72	21	20	21.4	11.010 913	0.80	6.70	11	44	56
	21	19	42	29.77	21	19	12.7	11.009 072	0.80	6.71	11	41	30
	22	19	42	59.77	21	18	03.7	11.006 969	0.80	6.71	11	38	04
	23	19	43	29.73	21	16	54.4	11.004 606	0.80	6.71	11	34	38
	24	19	43	59.63	-21	15	45.0	11.001 983	0.80	6.71	11	31	11
	25	19	44	29.47	21	14	35.4	10.999 100	0.80	6.71	11	27	45
	26	19	44	59.25	21	13	25.6	10.995 958	0.80	6.71	11	24	19
	27	19	45	28.95	21	12	15.6	10.992 558	0.80	6.72	11	20	52
	28	19	45	58.58	21	11	05.5	10.988 901	0.80	6.72	11	17	26
	29	19	46	28.13	21	09	55.3	10.984 988	0.80	6.72	11	13	59
	30	19	46	57.59	-21	08	44.8	10.980 820	0.80	6.72	11	10	33
	31	19	47	26.97	21	07	34.3	10.976 399	0.80	6.73	11	07	06
Feb.	1	19	47	56.25	21	06	23.7	10.971 726	0.80	6.73	11	03	39
	2	19	48	25.43	21	05	12.9	10.966 802	0.80	6.73	11	00	12
	3	19	48	54.52	21	04	02.1	10.961 629	0.80	6.73	10	56	45
	4	19	49	23.50	21	02	51.2	10.956 208	0.80	6.74	10	53	18
	5	19	49	52.37	-21	01	40.3	10.950 541	0.80	6.74	10	49	51
	6	19	50	21.12	21	00	29.4	10.944 630	0.80	6.74	10	46	24
	7	19	50	49.76	20	59	18.5	10.938 476	0.80	6.75	10	42	56
	8	19	51	18.27	20	58	07.7	10.932 081	0.80	6.75	10	39	28
	9	19	51	46.65	20	56	56.9	10.925 446	0.80	6.76	10	36	01
	10	19	52	14.89	20	55	46.1	10.918 573	0.81	6.76	10	32	33
	11	19	52	42.99	-20	54	35.5	10.911 464	0.81	6.77	10	29	05
	12	19	53	10.95	20	53	24.9	10.904 119	0.81	6.77	10	25	37
	13	19	53	38.75	20	52	14.4	10.896 541	0.81	6.77	10	22	08
	14	19	54	06.41	20	51	04.0	10.888 730	0.81	6.78	10	18	40
	15	19	54	33.92	-20	49	53.6	10.880 689	0.81	6.78	10	15	11

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		h	m	s	°	'	"		"	"	h	m	s
Feb.	15	19	54	33.92	-20	49	53.6	10.880 689	0.81	6.78	10	15	11
	16	19	55	01.27	20	48	43.5	10.872 417	0.81	6.79	10	11	43
	17	19	55	28.46	20	47	33.5	10.863 918	0.81	6.79	10	08	14
	18	19	55	55.48	20	46	23.6	10.855 193	0.81	6.80	10	04	45
	19	19	56	22.34	20	45	14.1	10.846 244	0.81	6.81	10	01	15
	20	19	56	49.01	20	44	04.7	10.837 072	0.81	6.81	9	57	46
	21	19	57	15.49	-20	42	55.6	10.827 681	0.81	6.82	9	54	16
	22	19	57	41.79	20	41	46.8	10.818 071	0.81	6.82	9	50	46
	23	19	58	07.88	20	40	38.3	10.808 247	0.81	6.83	9	47	16
	24	19	58	33.78	20	39	30.1	10.798 209	0.81	6.84	9	43	46
	25	19	58	59.47	20	38	22.2	10.787 961	0.82	6.84	9	40	16
	26	19	59	24.96	20	37	14.6	10.777 506	0.82	6.85	9	36	45
	27	19	59	50.22	-20	36	07.4	10.766 846	0.82	6.86	9	33	14
	28	20	00	15.28	20	35	00.5	10.755 984	0.82	6.86	9	29	43
	29	20	00	40.11	20	33	54.1	10.744 924	0.82	6.87	9	26	12
Mar.	1	20	01	04.72	20	32	48.0	10.733 667	0.82	6.88	9	22	40
	2	20	01	29.11	20	31	42.4	10.722 217	0.82	6.88	9	19	09
	3	20	01	53.26	20	30	37.2	10.710 577	0.82	6.89	9	15	37
	4	20	02	17.18	-20	29	32.5	10.698 751	0.82	6.90	9	12	04
	5	20	02	40.86	20	28	28.3	10.686 741	0.82	6.91	9	08	32
	6	20	03	04.30	20	27	24.6	10.674 550	0.82	6.92	9	04	59
	7	20	03	27.48	20	26	21.5	10.662 181	0.82	6.92	9	01	26
	8	20	03	50.41	20	25	18.9	10.649 639	0.83	6.93	8	57	53
	9	20	04	13.08	20	24	17.0	10.636 925	0.83	6.94	8	54	20
	10	20	04	35.49	-20	23	15.6	10.624 042	0.83	6.95	8	50	46
	11	20	04	57.63	20	22	14.8	10.610 993	0.83	6.96	8	47	12
	12	20	05	19.51	20	21	14.5	10.597 782	0.83	6.97	8	43	38
	13	20	05	41.11	20	20	14.9	10.584 410	0.83	6.97	8	40	03
	14	20	06	02.45	20	19	16.0	10.570 880	0.83	6.98	8	36	28
	15	20	06	23.52	20	18	17.7	10.557 196	0.83	6.99	8	32	53
	16	20	06	44.30	-20	17	20.0	10.543 361	0.83	7.00	8	29	18
	17	20	07	04.80	20	16	23.2	10.529 377	0.84	7.01	8	25	42
	18	20	07	25.01	20	15	27.0	10.515 248	0.84	7.02	8	22	07
	19	20	07	44.93	20	14	31.7	10.500 978	0.84	7.03	8	18	30
	20	20	08	04.54	20	13	37.1	10.486 569	0.84	7.04	8	14	54
	21	20	08	23.84	20	12	43.3	10.472 027	0.84	7.05	8	11	17
	22	20	08	42.84	-20	11	50.3	10.457 353	0.84	7.06	8	07	40
	23	20	09	01.52	20	10	58.2	10.442 552	0.84	7.07	8	04	02
	24	20	09	19.89	20	10	06.9	10.427 629	0.84	7.08	8	00	25
	25	20	09	37.94	20	09	16.4	10.412 586	0.84	7.09	7	56	47
	26	20	09	55.66	20	08	26.8	10.397 429	0.85	7.10	7	53	08
	27	20	10	13.06	20	07	38.1	10.382 161	0.85	7.11	7	49	30
	28	20	10	30.14	-20	06	50.3	10.366 786	0.85	7.12	7	45	51
	29	20	10	46.88	20	06	03.4	10.351 308	0.85	7.13	7	42	11
	30	20	11	03.30	20	05	17.5	10.335 732	0.85	7.14	7	38	32
	31	20	11	19.37	20	04	32.5	10.320 063	0.85	7.15	7	34	52
Apr.	1	20	11	35.11	-20	03	48.5	10.304 303	0.85	7.16	7	31	11

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		h	m	s	°	'	"		"	"	h	m	s
Apr.	1	20	11	35.11	-20	03	48.5	10.304 303	0.85	7.16	7	31	11
	2	20	11	50.51	20	03	05.6	10.288 457	0.85	7.18	7	27	30
	3	20	12	05.55	20	02	23.6	10.272 531	0.86	7.19	7	23	49
	4	20	12	20.25	20	01	42.7	10.256 527	0.86	7.20	7	20	08
	5	20	12	34.59	20	01	02.9	10.240 449	0.86	7.21	7	16	26
	6	20	12	48.57	20	00	24.1	10.224 303	0.86	7.22	7	12	44
	7	20	13	02.20	-19	59	46.4	10.208 092	0.86	7.23	7	09	02
	8	20	13	15.46	19	59	09.8	10.191 818	0.86	7.24	7	05	19
	9	20	13	28.37	19	58	34.2	10.175 488	0.86	7.25	7	01	36
	10	20	13	40.92	19	57	59.7	10.159 103	0.87	7.27	6	57	52
	11	20	13	53.10	19	57	26.2	10.142 668	0.87	7.28	6	54	08
	12	20	14	04.92	19	56	54.0	10.126 187	0.87	7.29	6	50	24
	13	20	14	16.37	-19	56	22.8	10.109 664	0.87	7.30	6	46	39
	14	20	14	27.45	19	55	52.9	10.093 102	0.87	7.31	6	42	54
	15	20	14	38.15	19	55	24.2	10.076 507	0.87	7.33	6	39	09
	16	20	14	48.47	19	54	56.6	10.059 882	0.87	7.34	6	35	23
	17	20	14	58.40	19	54	30.3	10.043 232	0.88	7.35	6	31	37
	18	20	15	07.94	19	54	05.2	10.026 562	0.88	7.36	6	27	51
	19	20	15	17.10	-19	53	41.3	10.009 876	0.88	7.37	6	24	04
	20	20	15	25.86	19	53	18.6	9.993 178	0.88	7.39	6	20	16
	21	20	15	34.23	19	52	57.2	9.976 475	0.88	7.40	6	16	29
	22	20	15	42.21	19	52	37.0	9.959 769	0.88	7.41	6	12	41
	23	20	15	49.79	19	52	18.0	9.943 066	0.88	7.42	6	08	52
	24	20	15	56.98	19	52	00.3	9.926 372	0.89	7.44	6	05	03
	25	20	16	03.77	-19	51	43.9	9.909 690	0.89	7.45	6	01	14
	26	20	16	10.17	19	51	28.8	9.893 026	0.89	7.46	5	57	24
	27	20	16	16.16	19	51	14.9	9.876 384	0.89	7.47	5	53	34
	28	20	16	21.76	19	51	02.4	9.859 770	0.89	7.49	5	49	44
	29	20	16	26.96	19	50	51.1	9.843 187	0.89	7.50	5	45	53
	30	20	16	31.75	19	50	41.2	9.826 642	0.89	7.51	5	42	02
May	1	20	16	36.14	-19	50	32.7	9.810 138	0.90	7.52	5	38	10
	2	20	16	40.13	19	50	25.4	9.793 681	0.90	7.54	5	34	18
	3	20	16	43.70	19	50	19.5	9.777 274	0.90	7.55	5	30	26
	4	20	16	46.87	19	50	14.9	9.760 923	0.90	7.56	5	26	33
	5	20	16	49.64	19	50	11.6	9.744 631	0.90	7.58	5	22	40
	6	20	16	52.00	19	50	09.6	9.728 402	0.90	7.59	5	18	46
	7	20	16	53.96	-19	50	08.9	9.712 242	0.91	7.60	5	14	52
	8	20	16	55.52	19	50	09.5	9.696 153	0.91	7.61	5	10	58
	9	20	16	56.69	19	50	11.4	9.680 140	0.91	7.63	5	07	03
	10	20	16	57.45	19	50	14.7	9.664 208	0.91	7.64	5	03	07
	11	20	16	57.81	19	50	19.3	9.648 360	0.91	7.65	4	59	12
	12	20	16	57.77	19	50	25.2	9.632 602	0.91	7.66	4	55	16
	13	20	16	57.32	-19	50	32.5	9.616 937	0.91	7.68	4	51	19
	14	20	16	56.47	19	50	41.1	9.601 370	0.92	7.69	4	47	22
	15	20	16	55.20	19	50	51.0	9.585 906	0.92	7.70	4	43	25
	16	20	16	53.54	19	51	02.3	9.570 549	0.92	7.71	4	39	28
	17	20	16	51.47	-19	51	14.8	9.555 305	0.92	7.73	4	35	30

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		h	m	s	°	'	"		"	"	h	m	s
May	17	20	16	51.47	-19	51	14.8	9.555 305	0.92	7.73	4	35	30
	18	20	16	48.99	19	51	28.7	9.540 178	0.92	7.74	4	31	31
	19	20	16	46.12	19	51	43.8	9.525 172	0.92	7.75	4	27	32
	20	20	16	42.85	19	52	00.3	9.510 293	0.92	7.76	4	23	33
	21	20	16	39.18	19	52	17.9	9.495 545	0.93	7.77	4	19	33
	22	20	16	35.12	19	52	36.9	9.480 933	0.93	7.79	4	15	33
	23	20	16	30.67	-19	52	57.1	9.466 462	0.93	7.80	4	11	33
	24	20	16	25.83	19	53	18.6	9.452 136	0.93	7.81	4	07	32
	25	20	16	20.61	19	53	41.4	9.437 961	0.93	7.82	4	03	31
	26	20	16	15.00	19	54	05.4	9.423 940	0.93	7.83	3	59	29
	27	20	16	09.01	19	54	30.6	9.410 078	0.93	7.84	3	55	28
	28	20	16	02.64	19	54	57.1	9.396 379	0.94	7.86	3	51	25
	29	20	15	55.89	-19	55	24.8	9.382 849	0.94	7.87	3	47	23
	30	20	15	48.76	19	55	53.7	9.369 490	0.94	7.88	3	43	19
	31	20	15	41.26	19	56	23.8	9.356 307	0.94	7.89	3	39	16
June	1	20	15	33.40	19	56	55.0	9.343 304	0.94	7.90	3	35	12
	2	20	15	25.17	19	57	27.3	9.330 484	0.94	7.91	3	31	08
	3	20	15	16.59	19	58	00.8	9.317 851	0.94	7.92	3	27	04
	4	20	15	07.67	-19	58	35.3	9.305 409	0.95	7.93	3	22	59
	5	20	14	58.39	19	59	10.8	9.293 160	0.95	7.94	3	18	54
	6	20	14	48.78	19	59	47.5	9.281 110	0.95	7.95	3	14	48
	7	20	14	38.83	20	00	25.2	9.269 260	0.95	7.96	3	10	42
	8	20	14	28.54	20	01	04.0	9.257 615	0.95	7.97	3	06	36
	9	20	14	17.92	20	01	43.8	9.246 178	0.95	7.98	3	02	30
	10	20	14	06.96	-20	02	24.7	9.234 953	0.95	7.99	2	58	23
	11	20	13	55.68	20	03	06.5	9.223 944	0.95	8.00	2	54	16
	12	20	13	44.08	20	03	49.3	9.213 154	0.95	8.01	2	50	08
	13	20	13	32.15	20	04	33.0	9.202 588	0.96	8.02	2	46	00
	14	20	13	19.92	20	05	17.6	9.192 248	0.96	8.03	2	41	52
	15	20	13	07.38	20	06	03.2	9.182 138	0.96	8.04	2	37	44
	16	20	12	54.54	-20	06	49.5	9.172 262	0.96	8.05	2	33	35
	17	20	12	41.42	20	07	36.8	9.162 624	0.96	8.06	2	29	26
	18	20	12	28.00	20	08	24.8	9.153 228	0.96	8.06	2	25	17
	19	20	12	14.31	20	09	13.6	9.144 075	0.96	8.07	2	21	07
	20	20	12	00.35	20	10	03.2	9.135 171	0.96	8.08	2	16	57
	21	20	11	46.13	20	10	53.5	9.126 517	0.96	8.09	2	12	47
	22	20	11	31.65	-20	11	44.6	9.118 118	0.96	8.10	2	08	37
	23	20	11	16.91	20	12	36.3	9.109 977	0.97	8.10	2	04	26
	24	20	11	01.93	20	13	28.8	9.102 095	0.97	8.11	2	00	16
	25	20	10	46.71	20	14	21.9	9.094 477	0.97	8.12	1	56	04
	26	20	10	31.25	20	15	15.7	9.087 124	0.97	8.12	1	51	53
	27	20	10	15.57	20	16	10.0	9.080 039	0.97	8.13	1	47	42
	28	20	09	59.68	-20	17	04.9	9.073 223	0.97	8.14	1	43	30
	29	20	09	43.58	20	18	00.3	9.066 680	0.97	8.14	1	39	18
	30	20	09	27.28	20	18	56.1	9.060 411	0.97	8.15	1	35	06
July	1	20	09	10.80	20	19	52.4	9.054 416	0.97	8.15	1	30	54
	2	20	08	54.14	-20	20	49.1	9.048 699	0.97	8.16	1	26	41

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		h	m	s	°	'	"		"	"	h	m	s
July	1	20	09	10.80	-20	19	52.4	9.054 416	0.97	8.15	1	30	54
	2	20	08	54.14	20	20	49.1	9.048 699	0.97	8.16	1	26	41
	3	20	08	37.32	20	21	46.2	9.043 261	0.97	8.16	1	22	28
	4	20	08	20.33	20	22	43.7	9.038 103	0.97	8.17	1	18	16
	5	20	08	03.18	20	23	41.5	9.033 227	0.97	8.17	1	14	03
	6	20	07	45.89	20	24	39.7	9.028 634	0.97	8.18	1	09	49
	7	20	07	28.45	-20	25	38.2	9.024 325	0.97	8.18	1	05	36
	8	20	07	10.87	20	26	37.0	9.020 304	0.97	8.18	1	01	23
	9	20	06	53.16	20	27	36.0	9.016 570	0.98	8.19	0	57	09
	10	20	06	35.34	20	28	35.2	9.013 126	0.98	8.19	0	52	56
	11	20	06	17.40	20	29	34.6	9.009 972	0.98	8.19	0	48	42
	12	20	05	59.37	20	30	34.2	9.007 111	0.98	8.20	0	44	28
	13	20	05	41.24	-20	31	33.8	9.004 544	0.98	8.20	0	40	14
	14	20	05	23.04	20	32	33.5	9.002 271	0.98	8.20	0	36	00
	15	20	05	04.76	20	33	33.3	9.000 294	0.98	8.20	0	31	46
	16	20	04	46.42	20	34	33.0	8.998 615	0.98	8.20	0	27	32
	17	20	04	28.04	20	35	32.8	8.997 233	0.98	8.20	0	23	18
	18	20	04	09.61	20	36	32.5	8.996 150	0.98	8.21	0	19	03
	19	20	03	51.15	-20	37	32.2	8.995 366	0.98	8.21	0	14	49
	20	20	03	32.66	20	38	31.8	8.994 882	0.98	8.21	0	10	35
	21	20	03	14.16	20	39	31.3	8.994 698	0.98	8.21	0	06	21
	22	20	02	55.65	20	40	30.7	8.994 815	0.98	8.21	0	02	06
	23	20	02	37.15	20	41	30.0	8.995 231	0.98	8.21	23	53	38
	24	20	02	18.65	20	42	29.0	8.995 948	0.98	8.21	23	49	23
	25	20	02	00.18	-20	43	27.8	8.996 965	0.98	8.20	23	45	09
	26	20	01	41.75	20	44	26.3	8.998 280	0.98	8.20	23	40	55
	27	20	01	23.36	20	45	24.5	8.999 893	0.98	8.20	23	36	41
	28	20	01	05.03	20	46	22.3	9.001 803	0.98	8.20	23	32	27
	29	20	00	46.77	20	47	19.8	9.004 009	0.98	8.20	23	28	13
	30	20	00	28.58	20	48	16.9	9.006 510	0.98	8.20	23	23	59
	31	20	00	10.48	-20	49	13.6	9.009 304	0.98	8.19	23	19	45
Aug.	1	19	59	52.48	20	50	09.9	9.012 391	0.98	8.19	23	15	31
	2	19	59	34.57	20	51	05.8	9.015 769	0.98	8.19	23	11	18
	3	19	59	16.77	20	52	01.2	9.019 437	0.98	8.18	23	07	04
	4	19	58	59.08	20	52	56.2	9.023 394	0.97	8.18	23	02	51
	5	19	58	41.52	20	53	50.7	9.027 637	0.97	8.18	22	58	38
	6	19	58	24.08	-20	54	44.6	9.032 168	0.97	8.17	22	54	24
	7	19	58	06.79	20	55	38.0	9.036 983	0.97	8.17	22	50	11
	8	19	57	49.64	20	56	30.8	9.042 081	0.97	8.16	22	45	59
	9	19	57	32.66	20	57	22.9	9.047 461	0.97	8.16	22	41	46
	10	19	57	15.84	20	58	14.5	9.053 122	0.97	8.15	22	37	34
	11	19	56	59.21	20	59	05.4	9.059 062	0.97	8.15	22	33	21
	12	19	56	42.76	-20	59	55.6	9.065 279	0.97	8.14	22	29	09
	13	19	56	26.51	21	00	45.1	9.071 771	0.97	8.14	22	24	57
	14	19	56	10.46	21	01	33.9	9.078 536	0.97	8.13	22	20	46
	15	19	55	54.62	21	02	22.0	9.085 573	0.97	8.12	22	16	34
	16	19	55	39.01	-21	03	09.4	9.092 878	0.97	8.12	22	12	23

SATURN, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Aug.	16	19	55	39.01	-21	03	09.4	9.092 878	0.97	8.12	22	12	23
	17	19	55	23.62	21	03	56.1	9.100 451	0.97	8.11	22	08	12
	18	19	55	08.47	21	04	42.0	9.108 288	0.97	8.10	22	04	01
	19	19	54	53.56	21	05	27.1	9.116 386	0.96	8.10	21	59	51
	20	19	54	38.90	21	06	11.5	9.124 743	0.96	8.09	21	55	40
	21	19	54	24.49	21	06	55.0	9.133 356	0.96	8.08	21	51	31
	22	19	54	10.35	-21	07	37.6	9.142 222	0.96	8.07	21	47	21
	23	19	53	56.49	21	08	19.4	9.151 336	0.96	8.07	21	43	11
	24	19	53	42.91	21	09	00.3	9.160 696	0.96	8.06	21	39	02
	25	19	53	29.63	21	09	40.3	9.170 297	0.96	8.05	21	34	53
	26	19	53	16.64	21	10	19.3	9.180 137	0.96	8.04	21	30	45
	27	19	53	03.97	21	10	57.5	9.190 212	0.96	8.03	21	26	37
	28	19	52	51.60	-21	11	34.7	9.200 518	0.96	8.02	21	22	29
	29	19	52	39.54	21	12	11.0	9.211 051	0.95	8.01	21	18	21
	30	19	52	27.80	21	12	46.5	9.221 807	0.95	8.00	21	14	14
	31	19	52	16.38	21	13	20.9	9.232 785	0.95	8.00	21	10	07
Sept.	1	19	52	05.29	21	13	54.4	9.243 979	0.95	7.99	21	06	00
	2	19	51	54.53	21	14	27.0	9.255 386	0.95	7.98	21	01	54
	3	19	51	44.10	-21	14	58.6	9.267 003	0.95	7.97	20	57	48
	4	19	51	34.02	21	15	29.1	9.278 826	0.95	7.96	20	53	42
	5	19	51	24.29	21	15	58.7	9.290 852	0.95	7.95	20	49	37
	6	19	51	14.91	21	16	27.2	9.303 076	0.95	7.94	20	45	32
	7	19	51	05.88	21	16	54.7	9.315 496	0.94	7.92	20	41	27
	8	19	50	57.23	21	17	21.2	9.328 108	0.94	7.91	20	37	23
	9	19	50	48.94	-21	17	46.6	9.340 907	0.94	7.90	20	33	19
	10	19	50	41.03	21	18	11.0	9.353 891	0.94	7.89	20	29	16
	11	19	50	33.49	21	18	34.4	9.367 054	0.94	7.88	20	25	13
	12	19	50	26.34	21	18	56.7	9.380 393	0.94	7.87	20	21	10
	13	19	50	19.57	21	19	18.0	9.393 905	0.94	7.86	20	17	08
	14	19	50	13.19	21	19	38.2	9.407 584	0.93	7.85	20	13	06
	15	19	50	07.20	-21	19	57.4	9.421 427	0.93	7.84	20	09	04
	16	19	50	01.59	21	20	15.6	9.435 428	0.93	7.82	20	05	03
	17	19	49	56.39	21	20	32.6	9.449 584	0.93	7.81	20	01	02
	18	19	49	51.58	21	20	48.6	9.463 890	0.93	7.80	19	57	02
	19	19	49	47.17	21	21	03.5	9.478 341	0.93	7.79	19	53	02
	20	19	49	43.18	21	21	17.2	9.492 931	0.93	7.78	19	49	03
	21	19	49	39.60	-21	21	29.8	9.507 656	0.92	7.76	19	45	04
	22	19	49	36.44	21	21	41.3	9.522 511	0.92	7.75	19	41	05
	23	19	49	33.69	21	21	51.7	9.537 490	0.92	7.74	19	37	06
	24	19	49	31.36	21	22	01.0	9.552 590	0.92	7.73	19	33	09
	25	19	49	29.44	21	22	09.2	9.567 804	0.92	7.72	19	29	11
	26	19	49	27.94	21	22	16.3	9.583 129	0.92	7.70	19	25	14
	27	19	49	26.86	-21	22	22.3	9.598 559	0.92	7.69	19	21	17
	28	19	49	26.18	21	22	27.3	9.614 091	0.91	7.68	19	17	21
	29	19	49	25.93	21	22	31.1	9.629 718	0.91	7.67	19	13	25
	30	19	49	26.08	21	22	33.8	9.645 438	0.91	7.65	19	09	30
Oct.	1	19	49	26.66	-21	22	35.4	9.661 246	0.91	7.64	19	05	35

SATURN, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Oct.	1	19	49	26.66	-21	22	35.4	9.661 246	0.91	7.64	19	05	35
	2	19	49	27.65	21	22	35.9	9.677 136	0.91	7.63	19	01	40
	3	19	49	29.07	21	22	35.3	9.693 105	0.91	7.62	18	57	46
	4	19	49	30.90	21	22	33.5	9.709 148	0.91	7.60	18	53	52
	5	19	49	33.15	21	22	30.6	9.725 260	0.90	7.59	18	49	59
	6	19	49	35.83	21	22	26.6	9.741 438	0.90	7.58	18	46	06
	7	19	49	38.93	-21	22	21.4	9.757 676	0.90	7.57	18	42	14
	8	19	49	42.45	21	22	15.2	9.773 971	0.90	7.55	18	38	22
	9	19	49	46.39	21	22	07.8	9.790 317	0.90	7.54	18	34	30
	10	19	49	50.75	21	21	59.4	9.806 710	0.90	7.53	18	30	39
	11	19	49	55.52	21	21	49.8	9.823 146	0.90	7.51	18	26	48
	12	19	50	00.72	21	21	39.2	9.839 619	0.89	7.50	18	22	57
	13	19	50	06.32	-21	21	27.4	9.856 125	0.89	7.49	18	19	07
	14	19	50	12.34	21	21	14.6	9.872 659	0.89	7.48	18	15	18
	15	19	50	18.78	21	21	00.6	9.889 216	0.89	7.46	18	11	29
	16	19	50	25.62	21	20	45.6	9.905 791	0.89	7.45	18	07	40
	17	19	50	32.88	21	20	29.3	9.922 378	0.89	7.44	18	03	51
	18	19	50	40.56	21	20	11.9	9.938 973	0.88	7.43	18	00	03
	19	19	50	48.65	-21	19	53.4	9.955 571	0.88	7.41	17	56	16
	20	19	50	57.16	21	19	33.8	9.972 165	0.88	7.40	17	52	29
	21	19	51	06.07	21	19	13.1	9.988 752	0.88	7.39	17	48	42
	22	19	51	15.39	21	18	51.3	10.005 326	0.88	7.38	17	44	56
	23	19	51	25.11	21	18	28.4	10.021 883	0.88	7.37	17	41	10
	24	19	51	35.22	21	18	04.5	10.038 417	0.88	7.35	17	37	24
	25	19	51	45.72	-21	17	39.5	10.054 925	0.87	7.34	17	33	39
	26	19	51	56.62	21	17	13.3	10.071 402	0.87	7.33	17	29	54
	27	19	52	07.89	21	16	46.1	10.087 844	0.87	7.32	17	26	10
	28	19	52	19.56	21	16	17.9	10.104 246	0.87	7.31	17	22	26
	29	19	52	31.60	21	15	48.5	10.120 604	0.87	7.29	17	18	42
	30	19	52	44.02	21	15	18.0	10.136 914	0.87	7.28	17	14	59
	31	19	52	56.83	-21	14	46.4	10.153 171	0.87	7.27	17	11	16
Nov.	1	19	53	10.00	21	14	13.8	10.169 373	0.86	7.26	17	07	33
	2	19	53	23.55	21	13	40.0	10.185 513	0.86	7.25	17	03	51
	3	19	53	37.48	21	13	05.2	10.201 589	0.86	7.24	17	00	09
	4	19	53	51.77	21	12	29.3	10.217 597	0.86	7.22	16	56	28
	5	19	54	06.42	21	11	52.4	10.233 532	0.86	7.21	16	52	47
	6	19	54	21.43	-21	11	14.5	10.249 390	0.86	7.20	16	49	06
	7	19	54	36.80	21	10	35.5	10.265 167	0.86	7.19	16	45	26
	8	19	54	52.52	21	09	55.4	10.280 859	0.86	7.18	16	41	46
	9	19	55	08.59	21	09	14.4	10.296 461	0.85	7.17	16	38	06
	10	19	55	25.00	21	08	32.3	10.311 971	0.85	7.16	16	34	27
	11	19	55	41.76	21	07	49.2	10.327 382	0.85	7.15	16	30	48
	12	19	55	58.85	-21	07	05.0	10.342 692	0.85	7.14	16	27	09
	13	19	56	16.27	21	06	19.8	10.357 895	0.85	7.13	16	23	31
	14	19	56	34.03	21	05	33.5	10.372 988	0.85	7.12	16	19	53
	15	19	56	52.13	21	04	46.1	10.387 965	0.85	7.11	16	16	15
	16	19	57	10.55	-21	03	57.7	10.402 822	0.85	7.10	16	12	38

SATURN, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Nov.	16	19	57	10.55	-21	03	57.7	10.402 822	0.85	7.10	16	12	38
	17	19	57	29.31	21	03	08.3	10.417 556	0.84	7.09	16	09	01
	18	19	57	48.37	21	02	17.9	10.432 161	0.84	7.08	16	05	24
	19	19	58	07.75	21	01	26.6	10.446 634	0.84	7.07	16	01	47
	20	19	58	27.44	21	00	34.2	10.460 972	0.84	7.06	15	58	11
	21	19	58	47.42	20	59	40.9	10.475 170	0.84	7.05	15	54	35
	22	19	59	07.70	-20	58	46.6	10.489 225	0.84	7.04	15	50	60
	23	19	59	28.26	20	57	51.3	10.503 133	0.84	7.03	15	47	25
	24	19	59	49.12	20	56	55.1	10.516 892	0.84	7.02	15	43	50
	25	20	00	10.25	20	55	57.8	10.530 498	0.84	7.01	15	40	15
	26	20	00	31.66	20	54	59.6	10.543 948	0.83	7.00	15	36	40
	27	20	00	53.35	20	54	00.5	10.557 238	0.83	6.99	15	33	06
	28	20	01	15.31	-20	53	00.3	10.570 366	0.83	6.98	15	29	32
	29	20	01	37.53	20	51	59.3	10.583 329	0.83	6.98	15	25	59
	30	20	02	00.02	20	50	57.2	10.596 123	0.83	6.97	15	22	25
Dec.	1	20	02	22.77	20	49	54.3	10.608 746	0.83	6.96	15	18	52
	2	20	02	45.78	20	48	50.4	10.621 194	0.83	6.95	15	15	19
	3	20	03	09.03	20	47	45.7	10.633 466	0.83	6.94	15	11	47
	4	20	03	32.53	-20	46	40.0	10.645 557	0.83	6.93	15	08	14
	5	20	03	56.26	20	45	33.5	10.657 466	0.83	6.93	15	04	42
	6	20	04	20.23	20	44	26.1	10.669 189	0.82	6.92	15	01	10
	7	20	04	44.42	20	43	17.8	10.680 722	0.82	6.91	14	57	39
	8	20	05	08.84	20	42	08.7	10.692 064	0.82	6.90	14	54	07
	9	20	05	33.48	20	40	58.7	10.703 212	0.82	6.90	14	50	36
	10	20	05	58.34	-20	39	47.8	10.714 161	0.82	6.89	14	47	05
	11	20	06	23.41	20	38	36.0	10.724 909	0.82	6.88	14	43	34
	12	20	06	48.70	20	37	23.3	10.735 453	0.82	6.88	14	40	03
	13	20	07	14.19	20	36	09.8	10.745 791	0.82	6.87	14	36	33
	14	20	07	39.88	20	34	55.5	10.755 918	0.82	6.86	14	33	03
	15	20	08	05.78	20	33	40.3	10.765 832	0.82	6.86	14	29	33
	16	20	08	31.86	-20	32	24.3	10.775 531	0.82	6.85	14	26	03
	17	20	08	58.13	20	31	07.6	10.785 012	0.82	6.84	14	22	33
	18	20	09	24.56	20	29	50.1	10.794 272	0.81	6.84	14	19	04
	19	20	09	51.17	20	28	31.9	10.803 310	0.81	6.83	14	15	34
	20	20	10	17.94	20	27	12.9	10.812 123	0.81	6.83	14	12	05
	21	20	10	44.87	20	25	53.1	10.820 710	0.81	6.82	14	08	36
	22	20	11	11.96	-20	24	32.6	10.829 069	0.81	6.82	14	05	07
	23	20	11	39.19	20	23	11.4	10.837 197	0.81	6.81	14	01	38
	24	20	12	06.58	20	21	49.4	10.845 094	0.81	6.81	13	58	10
	25	20	12	34.10	20	20	26.6	10.852 758	0.81	6.80	13	54	41
	26	20	13	01.76	20	19	03.2	10.860 187	0.81	6.80	13	51	13
	27	20	13	29.56	20	17	39.1	10.867 380	0.81	6.79	13	47	45
	28	20	13	57.49	-20	16	14.3	10.874 335	0.81	6.79	13	44	17
	29	20	14	25.54	20	14	48.9	10.881 051	0.81	6.78	13	40	49
	30	20	14	53.72	20	13	22.8	10.887 527	0.81	6.78	13	37	21
	31	20	15	22.00	20	11	56.1	10.893 761	0.81	6.78	13	33	53
	32	20	15	50.39	-20	10	28.8	10.899 752	0.81	6.77	13	30	26

URANUS, 2020

HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector	Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector
	° ′ ″	° ′ ″			° ′ ″	° ′ ″	
Jan. 1	35 19 18.0	-0 29 01.2	19.818 61	Apr. 2	36 20 08.4	-0 28 22.8	19.807 21
3	35 20 37.3	0 29 00.4	19.818 36	4	36 21 27.8	0 28 21.9	19.806 96
5	35 21 56.6	0 28 59.6	19.818 12	6	36 22 47.2	0 28 21.1	19.806 71
7	35 23 15.9	0 28 58.7	19.817 87	8	36 24 06.6	0 28 20.2	19.806 46
9	35 24 35.2	0 28 57.9	19.817 63	10	36 25 26.0	0 28 19.4	19.806 21
11	35 25 54.5	0 28 57.1	19.817 38	12	36 26 45.4	0 28 18.6	19.805 96
13	35 27 13.8	-0 28 56.3	19.817 13	14	36 28 04.8	-0 28 17.7	19.805 71
15	35 28 33.1	0 28 55.4	19.816 89	16	36 29 24.2	0 28 16.9	19.805 46
17	35 29 52.5	0 28 54.6	19.816 64	18	36 30 43.7	0 28 16.0	19.805 20
19	35 31 11.8	0 28 53.8	19.816 39	20	36 32 03.1	0 28 15.2	19.804 95
21	35 32 31.1	0 28 52.9	19.816 15	22	36 33 22.6	0 28 14.3	19.804 70
23	35 33 50.4	0 28 52.1	19.815 90	24	36 34 42.0	0 28 13.5	19.804 45
25	35 35 09.8	-0 28 51.3	19.815 65	26	36 36 01.4	-0 28 12.6	19.804 20
27	35 36 29.1	0 28 50.4	19.815 41	28	36 37 20.8	0 28 11.8	19.803 95
29	35 37 48.4	0 28 49.6	19.815 16	30	36 38 40.3	0 28 11.0	19.803 70
31	35 39 07.7	0 28 48.7	19.814 91	May 2	36 39 59.8	0 28 10.1	19.803 45
Feb. 2	35 40 27.1	0 28 47.9	19.814 66	4	36 41 19.2	0 28 09.3	19.803 20
4	35 41 46.4	0 28 47.1	19.814 42	6	36 42 38.6	0 28 08.4	19.802 95
6	35 43 05.8	-0 28 46.2	19.814 17	8	36 43 58.1	-0 28 07.6	19.802 70
8	35 44 25.1	0 28 45.4	19.813 92	10	36 45 17.6	0 28 06.7	19.802 44
10	35 45 44.5	0 28 44.6	19.813 67	12	36 46 37.0	0 28 05.9	19.802 19
12	35 47 03.8	0 28 43.7	19.813 43	14	36 47 56.5	0 28 05.0	19.801 94
14	35 48 23.2	0 28 42.9	19.813 18	16	36 49 15.9	0 28 04.2	19.801 69
16	35 49 42.5	0 28 42.1	19.812 93	18	36 50 35.4	0 28 03.3	19.801 44
18	35 51 01.9	-0 28 41.2	19.812 68	20	36 51 54.9	-0 28 02.5	19.801 19
20	35 52 21.2	0 28 40.4	19.812 44	22	36 53 14.3	0 28 01.6	19.800 93
22	35 53 40.6	0 28 39.5	19.812 19	24	36 54 33.8	0 28 00.8	19.800 68
24	35 54 60.0	0 28 38.7	19.811 94	26	36 55 53.3	0 27 59.9	19.800 43
26	35 56 19.3	0 28 37.9	19.811 69	28	36 57 12.8	0 27 59.1	19.800 18
28	35 57 38.7	0 28 37.1	19.811 44	30	36 58 32.2	0 27 58.2	19.799 93
Mar. 1	35 58 58.1	-0 28 36.2	19.811 19	June 1	36 59 51.7	-0 27 57.4	19.799 67
3	36 00 17.4	0 28 35.4	19.810 95	3	37 01 11.2	0 27 56.5	19.799 42
5	36 01 36.8	0 28 34.6	19.810 70	5	37 02 30.7	0 27 55.7	19.799 17
7	36 02 56.2	0 28 33.7	19.810 45	7	37 03 50.2	0 27 54.8	19.798 92
9	36 04 15.6	0 28 32.9	19.810 20	9	37 05 09.6	0 27 53.9	19.798 66
11	36 05 35.0	0 28 32.0	19.809 95	11	37 06 29.2	0 27 53.1	19.798 41
13	36 06 54.4	-0 28 31.2	19.809 70	13	37 07 48.6	-0 27 52.2	19.798 16
15	36 08 13.8	0 28 30.4	19.809 45	15	37 09 08.1	0 27 51.4	19.797 91
17	36 09 33.1	0 28 29.5	19.809 20	17	37 10 27.7	0 27 50.5	19.797 65
19	36 10 52.5	0 28 28.7	19.808 95	19	37 11 47.1	0 27 49.7	19.797 40
21	36 12 11.9	0 28 27.8	19.808 70	21	37 13 06.6	0 27 48.8	19.797 15
23	36 13 31.3	0 28 27.0	19.808 45	23	37 14 26.2	0 27 48.0	19.796 89
25	36 14 50.7	-0 28 26.1	19.808 21	25	37 15 45.7	-0 27 47.1	19.796 64
27	36 16 10.1	0 28 25.3	19.807 96	27	37 17 05.2	0 27 46.3	19.796 39
29	36 17 29.5	0 28 24.5	19.807 71	29	37 18 24.7	0 27 45.4	19.796 13
31	36 18 48.9	0 28 23.6	19.807 46	July 1	37 19 44.2	0 27 44.6	19.795 88
Apr. 2	36 20 08.4	-0 28 22.8	19.807 21	3	37 21 03.7	-0 27 43.7	19.795 63

URANUS, 2020
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude °	'	"	Heliocentric Latitude °	'	"	Radius Vector	Date		Heliocentric Longitude °	'	"	Heliocentric Latitude °	'	"	Radius Vector
July	1	37	19	44.2	-0	27	44.6	19.795 88	Oct.	1	38	20	44.9	-0	27	04.9	19.784 12
	3	37	21	03.7	0	27	43.7	19.795 63		3	38	22	04.5	0	27	04.1	19.783 86
	5	37	22	23.3	0	27	42.9	19.795 37		5	38	23	24.2	0	27	03.2	19.783 60
	7	37	23	42.8	0	27	42.0	19.795 12		7	38	24	43.8	0	27	02.4	19.783 35
	9	37	25	02.3	0	27	41.2	19.794 87		9	38	26	03.5	0	27	01.5	19.783 09
	11	37	26	21.9	0	27	40.3	19.794 61		11	38	27	23.1	0	27	00.6	19.782 83
	13	37	27	41.4	-0	27	39.4	19.794 36		13	38	28	42.8	-0	26	59.8	19.782 57
	15	37	29	00.9	0	27	38.6	19.794 10		15	38	30	02.4	0	26	58.9	19.782 31
	17	37	30	20.5	0	27	37.7	19.793 85		17	38	31	22.1	0	26	58.0	19.782 05
	19	37	31	40.0	0	27	36.9	19.793 60		19	38	32	41.8	0	26	57.1	19.781 80
	21	37	32	59.6	0	27	36.0	19.793 34		21	38	34	01.4	0	26	56.3	19.781 54
	23	37	34	19.1	0	27	35.2	19.793 09		23	38	35	21.1	0	26	55.4	19.781 28
	25	37	35	38.7	-0	27	34.3	19.792 83		25	38	36	40.7	-0	26	54.5	19.781 02
	27	37	36	58.2	0	27	33.4	19.792 58		27	38	38	00.4	0	26	53.7	19.780 76
	29	37	38	17.8	0	27	32.6	19.792 32		29	38	39	20.1	0	26	52.8	19.780 50
	31	37	39	37.3	0	27	31.7	19.792 07		31	38	40	39.8	0	26	51.9	19.780 24
Aug.	2	37	40	56.9	0	27	30.9	19.791 81	Nov.	2	38	41	59.4	0	26	51.1	19.779 98
	4	37	42	16.4	0	27	30.0	19.791 56		4	38	43	19.1	0	26	50.2	19.779 72
	6	37	43	36.0	-0	27	29.2	19.791 30		6	38	44	38.8	-0	26	49.3	19.779 46
	8	37	44	55.6	0	27	28.3	19.791 05		8	38	45	58.5	0	26	48.4	19.779 20
	10	37	46	15.1	0	27	27.4	19.790 79		10	38	47	18.1	0	26	47.6	19.778 94
	12	37	47	34.7	0	27	26.6	19.790 54		12	38	48	37.8	0	26	46.7	19.778 68
	14	37	48	54.3	0	27	25.7	19.790 28		14	38	49	57.5	0	26	45.8	19.778 42
	16	37	50	13.9	0	27	24.9	19.790 03		16	38	51	17.2	0	26	44.9	19.778 16
	18	37	51	33.5	-0	27	24.0	19.789 77		18	38	52	36.9	-0	26	44.1	19.777 90
	20	37	52	53.1	0	27	23.1	19.789 51		20	38	53	56.6	0	26	43.2	19.777 64
	22	37	54	12.6	0	27	22.2	19.789 26		22	38	55	16.3	0	26	42.3	19.777 38
	24	37	55	32.2	0	27	21.4	19.789 00		24	38	56	36.0	0	26	41.5	19.777 12
	26	37	56	51.8	0	27	20.5	19.788 75		26	38	57	55.7	0	26	40.6	19.776 86
	28	37	58	11.4	0	27	19.7	19.788 49		28	38	59	15.4	0	26	39.7	19.776 60
	30	37	59	31.0	-0	27	18.8	19.788 23		30	39	00	35.2	-0	26	38.8	19.776 34
Sept.	1	38	00	50.6	0	27	17.9	19.787 98	Dec.	2	39	01	54.9	0	26	38.0	19.776 08
	3	38	02	10.2	0	27	17.1	19.787 72		4	39	03	14.6	0	26	37.1	19.775 82
	5	38	03	29.8	0	27	16.2	19.787 46		6	39	04	34.3	0	26	36.2	19.775 56
	7	38	04	49.4	0	27	15.4	19.787 21		8	39	05	54.0	0	26	35.3	19.775 30
	9	38	06	09.0	0	27	14.5	19.786 95		10	39	07	13.8	0	26	34.4	19.775 04
	11	38	07	28.6	-0	27	13.6	19.786 69		12	39	08	33.5	-0	26	33.6	19.774 77
	13	38	08	48.2	0	27	12.8	19.786 44		14	39	09	53.2	0	26	32.7	19.774 51
	15	38	10	07.9	0	27	11.9	19.786 18		16	39	11	12.9	0	26	31.8	19.774 25
	17	38	11	27.5	0	27	11.0	19.785 92		18	39	12	32.7	0	26	30.9	19.773 99
	19	38	12	47.1	0	27	10.2	19.785 67		20	39	13	52.4	0	26	30.1	19.773 73
	21	38	14	06.7	0	27	09.3	19.785 41		22	39	15	12.2	0	26	29.2	19.773 47
	23	38	15	26.3	-0	27	08.4	19.785 15		24	39	16	31.9	-0	26	28.3	19.773 21
	25	38	16	46.0	0	27	07.6	19.784 89		26	39	17	51.7	0	26	27.4	19.772 94
	27	38	18	05.6	0	27	06.7	19.784 64		28	39	19	11.4	0	26	26.6	19.772 68
	29	38	19	25.3	0	27	05.8	19.784 38		30	39	20	31.1	0	26	25.7	19.772 42
Oct.	1	38	20	44.9	-0	27	04.9	19.784 12		32	39	21	50.9	-0	26	24.8	19.772 16

URANUS, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Jan.	0	32	42	11.7	-0	29	39.2	Feb.	15	33	10	18.5	-0	28	12.1
	1	32	41	38.8	0	29	37.4		16	33	12	04.9	0	28	10.4
	2	32	41	08.8	0	29	35.5		17	33	13	54.0	0	28	08.6
	3	32	40	42.0	0	29	33.6		18	33	15	45.8	0	28	06.9
	4	32	40	18.2	0	29	31.7		19	33	17	40.2	0	28	05.2
	5	32	39	57.5	0	29	29.8		20	33	19	37.2	0	28	03.5
	6	32	39	40.0	-0	29	27.8		21	33	21	36.8	-0	28	01.8
	7	32	39	25.6	0	29	25.9		22	33	23	38.9	0	28	00.2
	8	32	39	14.4	0	29	24.0		23	33	25	43.4	0	27	58.5
	9	32	39	06.3	0	29	22.1		24	33	27	50.5	0	27	56.9
	10	32	39	01.4	0	29	20.1		25	33	29	59.9	0	27	55.3
	11	32	38	59.6	0	29	18.2		26	33	32	11.7	0	27	53.7
	12	32	39	00.9	-0	29	16.2		27	33	34	25.9	-0	27	52.1
	13	32	39	05.3	0	29	14.3		28	33	36	42.5	0	27	50.5
	14	32	39	12.8	0	29	12.3		29	33	39	01.4	0	27	48.9
	15	32	39	23.3	0	29	10.4	Mar.	1	33	41	22.6	0	27	47.4
	16	32	39	37.0	0	29	08.4		2	33	43	46.0	0	27	45.8
	17	32	39	53.8	0	29	06.5		3	33	46	11.8	0	27	44.3
	18	32	40	13.8	-0	29	04.6		4	33	48	39.7	-0	27	42.8
	19	32	40	37.0	0	29	02.6		5	33	51	09.7	0	27	41.3
	20	32	41	03.3	0	29	00.7		6	33	53	41.9	0	27	39.8
	21	32	41	32.9	0	28	58.8		7	33	56	16.0	0	27	38.4
	22	32	42	05.6	0	28	56.8		8	33	58	52.2	0	27	37.0
	23	32	42	41.5	0	28	54.9		9	34	01	30.2	0	27	35.5
	24	32	43	20.5	-0	28	53.0		10	34	04	10.1	-0	27	34.1
	25	32	44	02.6	0	28	51.0		11	34	06	52.0	0	27	32.8
	26	32	44	47.7	0	28	49.1		12	34	09	35.6	0	27	31.4
	27	32	45	36.0	0	28	47.2		13	34	12	21.2	0	27	30.1
	28	32	46	27.3	0	28	45.3		14	34	15	08.7	0	27	28.8
	29	32	47	21.6	0	28	43.4		15	34	17	57.9	0	27	27.5
	30	32	48	19.0	-0	28	41.5		16	34	20	48.9	-0	27	26.2
	31	32	49	19.4	0	28	39.6		17	34	23	41.7	0	27	24.9
Feb.	1	32	50	22.9	0	28	37.7		18	34	26	36.1	0	27	23.7
	2	32	51	29.4	0	28	35.8		19	34	29	32.1	0	27	22.5
	3	32	52	38.9	0	28	33.9		20	34	32	29.7	0	27	21.2
	4	32	53	51.4	0	28	32.1		21	34	35	28.8	0	27	20.1
	5	32	55	07.0	-0	28	30.2		22	34	38	29.3	-0	27	18.9
	6	32	56	25.4	0	28	28.3		23	34	41	31.3	0	27	17.7
	7	32	57	46.8	0	28	26.5		24	34	44	34.7	0	27	16.6
	8	32	59	11.1	0	28	24.6		25	34	47	39.4	0	27	15.5
	9	33	00	38.2	0	28	22.8		26	34	50	45.5	0	27	14.4
	10	33	02	08.0	0	28	21.0		27	34	53	52.9	0	27	13.3
	11	33	03	40.6	-0	28	19.2		28	34	57	01.7	-0	27	12.3
	12	33	05	15.9	0	28	17.4		29	35	00	11.6	0	27	11.3
	13	33	06	54.0	0	28	15.6		30	35	03	22.8	0	27	10.2
	14	33	08	34.9	0	28	13.8		31	35	06	35.1	0	27	09.2
	15	33	10	18.5	-0	28	12.1	Apr.	1	35	09	48.5	-0	27	08.3

URANUS, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Apr.	1	35	09	48.5	-0	27	08.3	May	17	37	45	47.3	-0	26	46.3
	2	35	13	03.0	0	27	07.3		18	37	49	05.6	0	26	46.3
	3	35	16	18.5	0	27	06.4		19	37	52	23.0	0	26	46.4
	4	35	19	34.8	0	27	05.5		20	37	55	39.5	0	26	46.4
	5	35	22	52.0	0	27	04.6		21	37	58	55.2	0	26	46.5
	6	35	26	10.1	0	27	03.7		22	38	02	09.8	0	26	46.5
	7	35	29	28.9	-0	27	02.9		23	38	05	23.6	-0	26	46.6
	8	35	32	48.5	0	27	02.1		24	38	08	36.3	0	26	46.8
	9	35	36	08.9	0	27	01.3		25	38	11	47.9	0	26	46.9
	10	35	39	30.0	0	27	00.5		26	38	14	58.5	0	26	47.1
	11	35	42	51.9	0	26	59.7		27	38	18	07.8	0	26	47.2
	12	35	46	14.6	0	26	59.0		28	38	21	15.9	0	26	47.4
	13	35	49	37.8	-0	26	58.3		29	38	24	22.7	-0	26	47.6
	14	35	53	01.6	0	26	57.6		30	38	27	28.2	0	26	47.9
	15	35	56	25.9	0	26	56.9		31	38	30	32.3	0	26	48.1
	16	35	59	50.7	0	26	56.3	June	1	38	33	35.0	0	26	48.4
	17	36	03	15.8	0	26	55.6		2	38	36	36.4	0	26	48.7
	18	36	06	41.3	0	26	55.0		3	38	39	36.3	0	26	49.0
	19	36	10	07.2	-0	26	54.4		4	38	42	34.9	-0	26	49.3
	20	36	13	33.3	0	26	53.9		5	38	45	32.0	0	26	49.7
	21	36	16	59.8	0	26	53.3		6	38	48	27.7	0	26	50.0
	22	36	20	26.4	0	26	52.8		7	38	51	21.9	0	26	50.4
	23	36	23	53.3	0	26	52.3		8	38	54	14.5	0	26	50.8
	24	36	27	20.4	0	26	51.8		9	38	57	05.4	0	26	51.2
	25	36	30	47.7	-0	26	51.4		10	38	59	54.7	-0	26	51.7
	26	36	34	15.1	0	26	51.5		11	39	02	42.2	0	26	52.1
	27	36	37	41.4	0	26	50.8		12	39	05	28.0	0	26	52.6
	28	36	41	08.9	0	26	50.1		13	39	08	12.1	0	26	53.0
	29	36	44	36.3	0	26	49.7		14	39	10	54.3	0	26	53.5
	30	36	48	03.4	0	26	49.3		15	39	13	34.7	0	26	54.0
May	1	36	51	30.4	-0	26	48.9		16	39	16	13.2	-0	26	54.6
	2	36	54	57.0	0	26	48.6		17	39	18	49.9	0	26	55.1
	3	36	58	23.4	0	26	48.3		18	39	21	24.7	0	26	55.6
	4	37	01	49.5	0	26	48.0		19	39	23	57.6	0	26	56.2
	5	37	05	15.2	0	26	47.8		20	39	26	28.6	0	26	56.8
	6	37	08	40.6	0	26	47.5		21	39	28	57.6	0	26	57.4
	7	37	12	05.6	-0	26	47.3		22	39	31	24.5	-0	26	58.0
	8	37	15	30.3	0	26	47.1		23	39	33	49.4	0	26	58.6
	9	37	18	54.5	0	26	47.0		24	39	36	12.1	0	26	59.2
	10	37	22	18.3	0	26	46.8		25	39	38	32.6	0	26	59.9
	11	37	25	41.6	0	26	46.7		26	39	40	50.8	0	27	00.6
	12	37	29	04.3	0	26	46.6		27	39	43	06.8	0	27	01.2
	13	37	32	26.4	-0	26	46.5		28	39	45	20.6	-0	27	01.9
	14	37	35	47.8	0	26	46.4		29	39	47	32.1	0	27	02.6
	15	37	39	08.4	0	26	46.4		30	39	49	41.3	0	27	03.4
	16	37	42	28.3	0	26	46.3	July	1	39	51	48.2	0	27	04.1
	17	37	45	47.3	-0	26	46.3		2	39	53	52.9	-0	27	04.8

URANUS, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"	Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
July	1	39	51	48.2	-0	27	04.1	Aug.	16	40	41	30.6	-0	27	45.9
	2	39	53	52.9	0	27	04.8		17	40	41	27.9	0	27	46.8
	3	39	55	55.3	0	27	05.6		18	40	41	22.2	0	27	47.8
	4	39	57	55.4	0	27	06.4		19	40	41	13.4	0	27	48.7
	5	39	59	53.0	0	27	07.2		20	40	41	01.6	0	27	49.6
	6	40	01	48.2	0	27	08.0		21	40	40	46.8	0	27	50.6
	7	40	03	41.0	-0	27	08.8		22	40	40	29.0	-0	27	51.5
	8	40	05	31.2	0	27	09.6		23	40	40	08.3	0	27	52.4
	9	40	07	18.9	0	27	10.4		24	40	39	44.7	0	27	53.4
	10	40	09	04.0	0	27	11.2		25	40	39	18.2	0	27	54.3
	11	40	10	46.5	0	27	12.1		26	40	38	48.8	0	27	55.2
	12	40	12	26.5	0	27	12.9		27	40	38	16.6	0	27	56.1
	13	40	14	03.9	-0	27	13.8		28	40	37	41.6	-0	27	57.0
	14	40	15	38.7	0	27	14.6		29	40	37	03.6	0	27	57.8
	15	40	17	10.9	0	27	15.5		30	40	36	22.8	0	27	58.7
	16	40	18	40.4	0	27	16.4		31	40	35	39.2	0	27	59.6
	17	40	20	07.4	0	27	17.3	Sept.	1	40	34	52.7	0	28	00.4
	18	40	21	31.6	0	27	18.2		2	40	34	03.3	0	28	01.3
	19	40	22	53.1	-0	27	19.1		3	40	33	11.1	-0	28	02.1
	20	40	24	11.9	0	27	20.0		4	40	32	16.2	0	28	02.9
	21	40	25	27.9	0	27	20.9		5	40	31	18.5	0	28	03.7
	22	40	26	41.1	0	27	21.8		6	40	30	18.1	0	28	04.5
	23	40	27	51.4	0	27	22.7		7	40	29	15.1	0	28	05.2
	24	40	28	58.8	0	27	23.7		8	40	28	09.3	0	28	06.0
	25	40	30	03.4	-0	27	24.6		9	40	27	01.0	-0	28	06.7
	26	40	31	05.1	0	27	25.6		10	40	25	50.1	0	28	07.5
	27	40	32	03.9	0	27	26.5		11	40	24	36.6	0	28	08.2
	28	40	33	00.0	0	27	27.5		12	40	23	20.5	0	28	08.9
	29	40	33	53.2	0	27	28.4		13	40	22	01.9	0	28	09.6
	30	40	34	43.5	0	27	29.4		14	40	20	40.7	0	28	10.2
	31	40	35	31.0	-0	27	30.4		15	40	19	16.9	-0	28	10.9
Aug.	1	40	36	15.7	0	27	31.3		16	40	17	50.7	0	28	11.5
	2	40	36	57.4	0	27	32.3		17	40	16	21.9	0	28	12.1
	3	40	37	36.2	0	27	33.3		18	40	14	50.7	0	28	12.7
	4	40	38	12.0	0	27	34.3		19	40	13	17.2	0	28	13.3
	5	40	38	44.8	0	27	35.2		20	40	11	41.3	0	28	13.9
	6	40	39	14.7	-0	27	36.2		21	40	10	03.3	-0	28	14.4
	7	40	39	41.5	0	27	37.2		22	40	08	23.0	0	28	15.0
	8	40	40	05.4	0	27	38.2		23	40	06	40.7	0	28	15.5
	9	40	40	26.4	0	27	39.1		24	40	04	56.2	0	28	16.0
	10	40	40	44.4	0	27	40.1		25	40	03	09.5	0	28	16.5
	11	40	40	59.4	0	27	41.1		26	40	01	20.9	0	28	16.9
	12	40	41	11.6	-0	27	42.0		27	39	59	30.1	-0	28	17.3
	13	40	41	20.7	0	27	43.0		28	39	57	37.4	0	28	17.7
	14	40	41	27.0	0	27	44.0		29	39	55	42.6	0	28	18.1
	15	40	41	30.3	0	27	44.9		30	39	53	46.0	0	28	18.5
	16	40	41	30.6	-0	27	45.9	Oct.	1	39	51	47.5	-0	28	18.8

URANUS, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Oct.	1	39	51	47.5	-0	28	18.8	Nov.	16	38	03	45.6	-0	28	06.3
	2	39	49	47.2	0	28	19.1		17	38	01	25.4	0	28	05.4
	3	39	47	45.1	0	28	19.4		18	37	59	06.2	0	28	04.4
	4	39	45	41.4	0	28	19.7		19	37	56	48.2	0	28	03.5
	5	39	43	36.1	0	28	19.9		20	37	54	31.4	0	28	02.5
	6	39	41	29.2	0	28	20.2		21	37	52	15.7	0	28	01.5
	7	39	39	20.8	-0	28	20.3		22	37	50	01.3	-0	28	00.4
	8	39	37	10.9	0	28	20.5		23	37	47	48.2	0	27	59.4
	9	39	34	59.6	0	28	20.6		24	37	45	36.5	0	27	58.3
	10	39	32	46.9	0	28	20.8		25	37	43	26.3	0	27	57.2
	11	39	30	32.8	0	28	20.9		26	37	41	17.6	0	27	56.0
	12	39	28	17.5	0	28	20.9		27	37	39	10.5	0	27	54.9
	13	39	26	00.8	-0	28	21.0		28	37	37	05.0	-0	27	53.7
	14	39	23	42.9	0	28	21.0		29	37	35	01.3	0	27	52.4
	15	39	21	23.8	0	28	21.0		30	37	32	59.4	0	27	51.2
	16	39	19	03.7	0	28	20.9	Dec.	1	37	30	59.3	0	27	49.9
	17	39	16	42.6	0	28	20.9		2	37	29	01.1	0	27	48.7
	18	39	14	20.6	0	28	20.8		3	37	27	04.7	0	27	47.4
	19	39	11	57.8	-0	28	20.7		4	37	25	10.4	-0	27	46.0
	20	39	09	34.2	0	28	20.6		5	37	23	18.0	0	27	44.7
	21	39	07	10.0	0	28	20.4		6	37	21	27.6	0	27	43.3
	22	39	04	45.1	0	28	20.2		7	37	19	39.2	0	27	41.9
	23	39	02	19.6	0	28	20.0		8	37	17	52.9	0	27	40.5
	24	38	59	53.5	0	28	19.7		9	37	16	08.8	0	27	39.1
	25	38	57	26.8	-0	28	19.5		10	37	14	26.9	-0	27	37.7
	26	38	54	59.8	0	28	19.2		11	37	12	47.3	0	27	36.2
	27	38	52	32.3	0	28	18.8		12	37	11	10.1	0	27	34.7
	28	38	50	04.5	0	28	18.5		13	37	09	35.3	0	27	33.2
	29	38	47	36.5	0	28	18.1		14	37	08	03.1	0	27	31.7
	30	38	45	08.3	0	28	17.7		15	37	06	33.3	0	27	30.2
	31	38	42	40.0	-0	28	17.2		16	37	05	06.1	-0	27	28.7
Nov.	1	38	40	11.7	0	28	16.7		17	37	03	41.4	0	27	27.1
	2	38	37	43.5	0	28	16.2		18	37	02	19.2	0	27	25.5
	3	38	35	15.3	0	28	15.7		19	37	00	59.7	0	27	23.9
	4	38	32	47.4	0	28	15.1		20	36	59	42.7	0	27	22.3
	5	38	30	19.7	0	28	14.5		21	36	58	28.4	0	27	20.7
	6	38	27	52.3	-0	28	13.9		22	36	57	16.8	-0	27	19.1
	7	38	25	25.2	0	28	13.3		23	36	56	07.9	0	27	17.4
	8	38	22	58.4	0	28	12.6		24	36	55	01.9	0	27	15.7
	9	38	20	32.1	0	28	11.9		25	36	53	58.7	0	27	14.1
	10	38	18	06.2	0	28	11.2		26	36	52	58.3	0	27	12.4
	11	38	15	40.9	0	28	10.4		27	36	52	00.9	0	27	10.7
	12	38	13	16.2	-0	28	09.6		28	36	51	06.3	-0	27	09.0
	13	38	10	52.2	0	28	08.8		29	36	50	14.7	0	27	07.2
	14	38	08	29.0	0	28	08.0		30	36	49	26.1	0	27	05.5
	15	38	06	06.8	0	28	07.1		31	36	48	40.4	0	27	03.7
	16	38	03	45.6	-0	28	06.3		32	36	47	57.6	-0	27	02.0

URANUS, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Jan.	0	2	02	42.11	+11	56	40.5	19.402 930	0.45	1.80	19	22	58
	1	2	02	39.96	11	56	31.0	19.418 725	0.45	1.80	19	19	00
	2	2	02	38.00	11	56	22.5	19.434 636	0.45	1.80	19	15	02
	3	2	02	36.23	11	56	15.1	19.450 658	0.45	1.80	19	11	05
	4	2	02	34.67	11	56	08.8	19.466 787	0.45	1.80	19	07	07
	5	2	02	33.30	11	56	03.5	19.483 016	0.45	1.80	19	03	10
	6	2	02	32.13	+11	55	59.3	19.499 341	0.45	1.80	18	59	13
	7	2	02	31.17	11	55	56.1	19.515 755	0.45	1.79	18	55	16
	8	2	02	30.40	11	55	54.1	19.532 255	0.45	1.79	18	51	20
	9	2	02	29.84	11	55	53.2	19.548 834	0.45	1.79	18	47	24
	10	2	02	29.48	11	55	53.3	19.565 489	0.45	1.79	18	43	28
	11	2	02	29.32	11	55	54.5	19.582 213	0.45	1.79	18	39	32
	12	2	02	29.36	+11	55	56.8	19.599 002	0.45	1.79	18	35	36
	13	2	02	29.60	11	56	00.2	19.615 851	0.45	1.79	18	31	40
	14	2	02	30.03	11	56	04.6	19.632 755	0.45	1.78	18	27	45
	15	2	02	30.66	11	56	10.1	19.649 709	0.45	1.78	18	23	50
	16	2	02	31.49	11	56	16.6	19.666 708	0.45	1.78	18	19	55
	17	2	02	32.52	11	56	24.2	19.683 748	0.45	1.78	18	16	00
	18	2	02	33.75	+11	56	32.9	19.700 823	0.45	1.78	18	12	06
	19	2	02	35.19	11	56	42.6	19.717 927	0.45	1.78	18	08	11
	20	2	02	36.83	11	56	53.4	19.735 055	0.45	1.77	18	04	17
	21	2	02	38.68	11	57	05.4	19.752 203	0.45	1.77	18	00	23
	22	2	02	40.73	11	57	18.4	19.769 363	0.44	1.77	17	56	30
	23	2	02	42.98	11	57	32.5	19.786 531	0.44	1.77	17	52	36
	24	2	02	45.43	+11	57	47.6	19.803 702	0.44	1.77	17	48	43
	25	2	02	48.08	11	58	03.9	19.820 868	0.44	1.77	17	44	50
	26	2	02	50.93	11	58	21.1	19.838 026	0.44	1.77	17	40	57
	27	2	02	53.97	11	58	39.5	19.855 169	0.44	1.76	17	37	04
	28	2	02	57.21	11	58	58.8	19.872 291	0.44	1.76	17	33	11
	29	2	03	00.65	11	59	19.2	19.889 388	0.44	1.76	17	29	19
	30	2	03	04.28	+11	59	40.6	19.906 455	0.44	1.76	17	25	27
	31	2	03	08.10	12	00	03.1	19.923 485	0.44	1.76	17	21	35
Feb.	1	2	03	12.12	12	00	26.5	19.940 473	0.44	1.76	17	17	43
	2	2	03	16.34	12	00	51.0	19.957 415	0.44	1.75	17	13	52
	3	2	03	20.75	12	01	16.5	19.974 305	0.44	1.75	17	10	00
	4	2	03	25.35	12	01	43.1	19.991 139	0.44	1.75	17	06	09
	5	2	03	30.15	+12	02	10.6	20.007 912	0.44	1.75	17	02	18
	6	2	03	35.13	12	02	39.1	20.024 618	0.44	1.75	16	58	27
	7	2	03	40.31	12	03	08.7	20.041 254	0.44	1.75	16	54	37
	8	2	03	45.66	12	03	39.2	20.057 814	0.44	1.75	16	50	46
	9	2	03	51.20	12	04	10.6	20.074 295	0.44	1.74	16	46	56
	10	2	03	56.91	12	04	43.0	20.090 692	0.44	1.74	16	43	06
	11	2	04	02.80	+12	05	16.3	20.107 001	0.44	1.74	16	39	16
	12	2	04	08.87	12	05	50.5	20.123 217	0.44	1.74	16	35	26
	13	2	04	15.12	12	06	25.6	20.139 336	0.44	1.74	16	31	36
	14	2	04	21.54	12	07	01.7	20.155 355	0.44	1.74	16	27	47
	15	2	04	28.14	+12	07	38.6	20.171 267	0.44	1.74	16	23	58

URANUS, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Feb.	15	2	04	28.14	+12	07	38.6	20.171 267	0.44	1.74	16	23	58
	16	2	04	34.92	12	08	16.4	20.187 069	0.44	1.73	16	20	09
	17	2	04	41.88	12	08	55.2	20.202 757	0.44	1.73	16	16	20
	18	2	04	49.01	12	09	34.8	20.218 324	0.43	1.73	16	12	31
	19	2	04	56.31	12	10	15.4	20.233 768	0.43	1.73	16	08	43
	20	2	05	03.77	12	10	56.8	20.249 083	0.43	1.73	16	04	54
	21	2	05	11.40	+12	11	39.0	20.264 264	0.43	1.73	16	01	06
	22	2	05	19.20	12	12	22.1	20.279 308	0.43	1.73	15	57	18
	23	2	05	27.15	12	13	06.0	20.294 209	0.43	1.73	15	53	30
	24	2	05	35.26	12	13	50.7	20.308 963	0.43	1.72	15	49	42
	25	2	05	43.52	12	14	36.2	20.323 566	0.43	1.72	15	45	55
	26	2	05	51.94	12	15	22.4	20.338 014	0.43	1.72	15	42	07
	27	2	06	00.52	+12	16	09.4	20.352 303	0.43	1.72	15	38	20
	28	2	06	09.25	12	16	57.2	20.366 428	0.43	1.72	15	34	33
	29	2	06	18.13	12	17	45.8	20.380 386	0.43	1.72	15	30	46
Mar.	1	2	06	27.16	12	18	35.1	20.394 173	0.43	1.72	15	26	59
	2	2	06	36.33	12	19	25.1	20.407 786	0.43	1.72	15	23	13
	3	2	06	45.66	12	20	15.8	20.421 220	0.43	1.71	15	19	26
	4	2	06	55.12	+12	21	07.3	20.434 473	0.43	1.71	15	15	40
	5	2	07	04.72	12	21	59.5	20.447 541	0.43	1.71	15	11	53
	6	2	07	14.46	12	22	52.3	20.460 422	0.43	1.71	15	08	07
	7	2	07	24.33	12	23	45.8	20.473 111	0.43	1.71	15	04	21
	8	2	07	34.33	12	24	39.9	20.485 607	0.43	1.71	15	00	35
	9	2	07	44.45	12	25	34.6	20.497 906	0.43	1.71	14	56	49
	10	2	07	54.69	+12	26	29.9	20.510 006	0.43	1.71	14	53	04
	11	2	08	05.06	12	27	25.8	20.521 904	0.43	1.71	14	49	18
	12	2	08	15.55	12	28	22.3	20.533 598	0.43	1.71	14	45	33
	13	2	08	26.16	12	29	19.3	20.545 084	0.43	1.70	14	41	48
	14	2	08	36.90	12	30	17.0	20.556 359	0.43	1.70	14	38	03
	15	2	08	47.75	12	31	15.1	20.567 421	0.43	1.70	14	34	17
	16	2	08	58.72	+12	32	13.9	20.578 267	0.43	1.70	14	30	33
	17	2	09	09.80	12	33	13.2	20.588 893	0.43	1.70	14	26	48
	18	2	09	20.99	12	34	13.0	20.599 297	0.43	1.70	14	23	03
	19	2	09	32.29	12	35	13.3	20.609 476	0.43	1.70	14	19	18
	20	2	09	43.69	12	36	14.0	20.619 427	0.43	1.70	14	15	34
	21	2	09	55.18	12	37	15.3	20.629 147	0.43	1.70	14	11	49
	22	2	10	06.77	+12	38	17.0	20.638 634	0.43	1.70	14	08	05
	23	2	10	18.46	12	39	19.1	20.647 884	0.43	1.70	14	04	21
	24	2	10	30.24	12	40	21.6	20.656 896	0.43	1.70	14	00	37
	25	2	10	42.11	12	41	24.5	20.665 667	0.43	1.69	13	56	53
	26	2	10	54.07	12	42	27.8	20.674 195	0.43	1.69	13	53	09
	27	2	11	06.12	12	43	31.5	20.682 479	0.43	1.69	13	49	25
	28	2	11	18.25	+12	44	35.6	20.690 514	0.43	1.69	13	45	41
	29	2	11	30.46	12	45	40.0	20.698 301	0.42	1.69	13	41	57
	30	2	11	42.76	12	46	44.8	20.705 838	0.42	1.69	13	38	14
	31	2	11	55.13	12	47	49.9	20.713 122	0.42	1.69	13	34	30
Apr.	1	2	12	07.57	+12	48	55.3	20.720 152	0.42	1.69	13	30	47

URANUS, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Apr.	1	2	12	07.57	+12	48	55.3	20.720 152	0.42	1.69	13	30	47
	2	2	12	20.09	12	50	01.1	20.726 927	0.42	1.69	13	27	03
	3	2	12	32.66	12	51	07.1	20.733 445	0.42	1.69	13	23	20
	4	2	12	45.30	12	52	13.3	20.739 707	0.42	1.69	13	19	37
	5	2	12	58.00	12	53	19.8	20.745 710	0.42	1.69	13	15	53
	6	2	13	10.75	12	54	26.5	20.751 454	0.42	1.69	13	12	10
	7	2	13	23.56	+12	55	33.4	20.756 937	0.42	1.69	13	08	27
	8	2	13	36.42	12	56	40.5	20.762 160	0.42	1.69	13	04	44
	9	2	13	49.33	12	57	47.7	20.767 121	0.42	1.69	13	01	01
	10	2	14	02.30	12	58	55.1	20.771 819	0.42	1.69	12	57	18
	11	2	14	15.31	13	00	02.8	20.776 254	0.42	1.69	12	53	35
	12	2	14	28.38	13	01	10.6	20.780 424	0.42	1.69	12	49	52
	13	2	14	41.48	+13	02	18.5	20.784 327	0.42	1.68	12	46	09
	14	2	14	54.63	13	03	26.6	20.787 964	0.42	1.68	12	42	26
	15	2	15	07.81	13	04	34.8	20.791 332	0.42	1.68	12	38	44
	16	2	15	21.02	13	05	43.1	20.794 432	0.42	1.68	12	35	01
	17	2	15	34.26	13	06	51.5	20.797 261	0.42	1.68	12	31	18
	18	2	15	47.53	13	07	59.9	20.799 819	0.42	1.68	12	27	35
	19	2	16	00.82	+13	09	08.3	20.802 106	0.42	1.68	12	23	53
	20	2	16	14.13	13	10	16.8	20.804 121	0.42	1.68	12	20	10
	21	2	16	27.46	13	11	25.3	20.805 862	0.42	1.68	12	16	28
	22	2	16	40.81	13	12	33.9	20.807 331	0.42	1.68	12	12	45
	23	2	16	54.18	13	13	42.4	20.808 527	0.42	1.68	12	09	02
	24	2	17	07.56	13	14	50.9	20.809 449	0.42	1.68	12	05	20
	25	2	17	20.96	+13	15	59.3	20.810 097	0.42	1.68	12	01	37
	26	2	17	34.38	13	17	07.3	20.810 472	0.42	1.68	11	57	55
	27	2	17	47.72	13	18	15.6	20.810 574	0.42	1.68	11	54	12
	28	2	18	01.14	13	19	24.3	20.810 402	0.42	1.68	11	50	29
	29	2	18	14.55	13	20	32.7	20.809 959	0.42	1.68	11	46	47
	30	2	18	27.95	13	21	40.9	20.809 243	0.42	1.68	11	43	04
May	1	2	18	41.34	+13	22	48.9	20.808 256	0.42	1.68	11	39	22
	2	2	18	54.72	13	23	56.8	20.806 999	0.42	1.68	11	35	39
	3	2	19	08.08	13	25	04.6	20.805 472	0.42	1.68	11	31	56
	4	2	19	21.42	13	26	12.1	20.803 677	0.42	1.68	11	28	14
	5	2	19	34.74	13	27	19.5	20.801 614	0.42	1.68	11	24	31
	6	2	19	48.05	13	28	26.7	20.799 285	0.42	1.68	11	20	48
	7	2	20	01.33	+13	29	33.7	20.796 690	0.42	1.68	11	17	06
	8	2	20	14.59	13	30	40.5	20.793 830	0.42	1.68	11	13	23
	9	2	20	27.83	13	31	47.1	20.790 706	0.42	1.68	11	09	40
	10	2	20	41.05	13	32	53.5	20.787 319	0.42	1.68	11	05	57
	11	2	20	54.23	13	33	59.7	20.783 669	0.42	1.68	11	02	15
	12	2	21	07.37	13	35	05.6	20.779 756	0.42	1.69	10	58	32
	13	2	21	20.48	+13	36	11.3	20.775 583	0.42	1.69	10	54	49
	14	2	21	33.54	13	37	16.7	20.771 148	0.42	1.69	10	51	06
	15	2	21	46.56	13	38	21.8	20.766 454	0.42	1.69	10	47	23
	16	2	21	59.53	13	39	26.6	20.761 502	0.42	1.69	10	43	40
	17	2	22	12.45	+13	40	31.0	20.756 291	0.42	1.69	10	39	57

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Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
May	17	2	22	12.45	+13	40	31.0	20.756 291	0.42	1.69	10	39	57
	18	2	22	25.32	13	41	35.1	20.750 824	0.42	1.69	10	36	14
	19	2	22	38.14	13	42	38.9	20.745 102	0.42	1.69	10	32	31
	20	2	22	50.91	13	43	42.4	20.739 127	0.42	1.69	10	28	47
	21	2	23	03.62	13	44	45.4	20.732 898	0.42	1.69	10	25	04
	22	2	23	16.27	13	45	48.1	20.726 419	0.42	1.69	10	21	21
	23	2	23	28.86	+13	46	50.5	20.719 692	0.42	1.69	10	17	37
	24	2	23	41.38	13	47	52.4	20.712 716	0.42	1.69	10	13	54
	25	2	23	53.84	13	48	54.0	20.705 496	0.42	1.69	10	10	10
	26	2	24	06.23	13	49	55.1	20.698 033	0.42	1.69	10	06	27
	27	2	24	18.54	13	50	55.9	20.690 328	0.43	1.69	10	02	43
	28	2	24	30.78	13	51	56.2	20.682 385	0.43	1.69	9	58	59
	29	2	24	42.93	+13	52	56.0	20.674 206	0.43	1.69	9	55	15
	30	2	24	55.00	13	53	55.3	20.665 793	0.43	1.69	9	51	31
	31	2	25	06.98	13	54	54.1	20.657 149	0.43	1.70	9	47	47
June	1	2	25	18.87	13	55	52.5	20.648 276	0.43	1.70	9	44	03
	2	2	25	30.68	13	56	50.3	20.639 178	0.43	1.70	9	40	19
	3	2	25	42.40	13	57	47.6	20.629 855	0.43	1.70	9	36	35
	4	2	25	54.03	+13	58	44.3	20.620 311	0.43	1.70	9	32	50
	5	2	26	05.57	13	59	40.6	20.610 549	0.43	1.70	9	29	06
	6	2	26	17.01	14	00	36.4	20.600 569	0.43	1.70	9	25	21
	7	2	26	28.36	14	01	31.6	20.590 376	0.43	1.70	9	21	37
	8	2	26	39.61	14	02	26.3	20.579 970	0.43	1.70	9	17	52
	9	2	26	50.75	14	03	20.5	20.569 355	0.43	1.70	9	14	07
	10	2	27	01.79	+14	04	14.0	20.558 532	0.43	1.70	9	10	22
	11	2	27	12.71	14	05	07.0	20.547 504	0.43	1.70	9	06	37
	12	2	27	23.52	14	05	59.4	20.536 273	0.43	1.71	9	02	52
	13	2	27	34.22	14	06	51.1	20.524 842	0.43	1.71	8	59	06
	14	2	27	44.80	14	07	42.3	20.513 213	0.43	1.71	8	55	21
	15	2	27	55.27	14	08	32.8	20.501 389	0.43	1.71	8	51	35
	16	2	28	05.62	+14	09	22.6	20.489 373	0.43	1.71	8	47	50
	17	2	28	15.85	14	10	11.8	20.477 167	0.43	1.71	8	44	04
	18	2	28	25.95	14	11	00.4	20.464 776	0.43	1.71	8	40	18
	19	2	28	35.94	14	11	48.4	20.452 201	0.43	1.71	8	36	32
	20	2	28	45.80	14	12	35.6	20.439 446	0.43	1.71	8	32	46
	21	2	28	55.53	14	13	22.3	20.426 514	0.43	1.71	8	28	60
	22	2	29	05.13	+14	14	08.2	20.413 410	0.43	1.72	8	25	13
	23	2	29	14.59	14	14	53.5	20.400 135	0.43	1.72	8	21	27
	24	2	29	23.91	14	15	38.0	20.386 695	0.43	1.72	8	17	40
	25	2	29	33.10	14	16	21.8	20.373 092	0.43	1.72	8	13	53
	26	2	29	42.14	14	17	04.9	20.359 331	0.43	1.72	8	10	06
	27	2	29	51.03	14	17	47.3	20.345 415	0.43	1.72	8	06	19
	28	2	29	59.77	+14	18	28.8	20.331 349	0.43	1.72	8	02	32
	29	2	30	08.37	14	19	09.7	20.317 136	0.43	1.72	7	58	44
	30	2	30	16.82	14	19	49.7	20.302 779	0.43	1.72	7	54	57
July	1	2	30	25.13	14	20	29.0	20.288 284	0.43	1.73	7	51	09
	2	2	30	33.29	+14	21	07.5	20.273 653	0.43	1.73	7	47	21

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Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
July	1	2	30	25.13	+14	20	29.0	20.288 284	0.43	1.73	7	51	09
	2	2	30	33.29	14	21	07.5	20.273 653	0.43	1.73	7	47	21
	3	2	30	41.30	14	21	45.3	20.258 889	0.43	1.73	7	43	33
	4	2	30	49.16	14	22	22.4	20.243 997	0.43	1.73	7	39	45
	5	2	30	56.86	14	22	58.7	20.228 981	0.43	1.73	7	35	57
	6	2	31	04.41	14	23	34.2	20.213 842	0.44	1.73	7	32	08
	7	2	31	11.79	+14	24	08.9	20.198 586	0.44	1.73	7	28	20
	8	2	31	19.01	14	24	42.8	20.183 215	0.44	1.74	7	24	31
	9	2	31	26.06	14	25	15.8	20.167 734	0.44	1.74	7	20	42
	10	2	31	32.95	14	25	48.1	20.152 145	0.44	1.74	7	16	53
	11	2	31	39.67	14	26	19.5	20.136 452	0.44	1.74	7	13	04
	12	2	31	46.22	14	26	50.1	20.120 660	0.44	1.74	7	09	14
	13	2	31	52.61	+14	27	19.8	20.104 772	0.44	1.74	7	05	25
	14	2	31	58.82	14	27	48.7	20.088 792	0.44	1.74	7	01	35
	15	2	32	04.87	14	28	16.7	20.072 724	0.44	1.74	6	57	45
	16	2	32	10.74	14	28	44.0	20.056 573	0.44	1.75	6	53	55
	17	2	32	16.45	14	29	10.3	20.040 342	0.44	1.75	6	50	04
	18	2	32	21.97	14	29	35.8	20.024 036	0.44	1.75	6	46	14
	19	2	32	27.33	+14	30	00.5	20.007 660	0.44	1.75	6	42	23
	20	2	32	32.50	14	30	24.3	19.991 218	0.44	1.75	6	38	33
	21	2	32	37.49	14	30	47.3	19.974 714	0.44	1.75	6	34	42
	22	2	32	42.29	14	31	09.3	19.958 154	0.44	1.75	6	30	50
	23	2	32	46.91	14	31	30.5	19.941 542	0.44	1.76	6	26	59
	24	2	32	51.34	14	31	50.7	19.924 883	0.44	1.76	6	23	07
	25	2	32	55.58	+14	32	10.0	19.908 181	0.44	1.76	6	19	16
	26	2	32	59.64	14	32	28.4	19.891 443	0.44	1.76	6	15	24
	27	2	33	03.51	14	32	45.9	19.874 671	0.44	1.76	6	11	32
	28	2	33	07.20	14	33	02.4	19.857 872	0.44	1.76	6	07	39
	29	2	33	10.70	14	33	18.1	19.841 050	0.44	1.77	6	03	47
	30	2	33	14.02	14	33	32.9	19.824 208	0.44	1.77	5	59	54
	31	2	33	17.15	+14	33	46.8	19.807 352	0.44	1.77	5	56	01
Aug.	1	2	33	20.09	14	33	59.8	19.790 486	0.44	1.77	5	52	08
	2	2	33	22.84	14	34	11.9	19.773 613	0.44	1.77	5	48	15
	3	2	33	25.40	14	34	23.1	19.756 739	0.45	1.77	5	44	22
	4	2	33	27.76	14	34	33.4	19.739 868	0.45	1.77	5	40	28
	5	2	33	29.93	14	34	42.8	19.723 004	0.45	1.78	5	36	34
	6	2	33	31.90	+14	34	51.2	19.706 151	0.45	1.78	5	32	40
	7	2	33	33.68	14	34	58.7	19.689 313	0.45	1.78	5	28	46
	8	2	33	35.27	14	35	05.2	19.672 496	0.45	1.78	5	24	52
	9	2	33	36.66	14	35	10.8	19.655 703	0.45	1.78	5	20	57
	10	2	33	37.86	14	35	15.5	19.638 939	0.45	1.78	5	17	02
	11	2	33	38.86	14	35	19.3	19.622 209	0.45	1.78	5	13	08
	12	2	33	39.68	+14	35	22.1	19.605 518	0.45	1.79	5	09	12
	13	2	33	40.30	14	35	24.1	19.588 870	0.45	1.79	5	05	17
	14	2	33	40.73	14	35	25.1	19.572 270	0.45	1.79	5	01	22
	15	2	33	40.96	14	35	25.2	19.555 722	0.45	1.79	4	57	26
	16	2	33	41.00	+14	35	24.4	19.539 233	0.45	1.79	4	53	30

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		h	m	s	°	'	"		"	"	h	m	s
Aug.	16	2	33	41.00	+14	35	24.4	19.539 233	0.45	1.79	4	53	30
	17	2	33	40.85	14	35	22.7	19.522 807	0.45	1.79	4	49	34
	18	2	33	40.49	14	35	20.1	19.506 449	0.45	1.80	4	45	37
	19	2	33	39.94	14	35	16.5	19.490 163	0.45	1.80	4	41	41
	20	2	33	39.19	14	35	12.0	19.473 957	0.45	1.80	4	37	44
	21	2	33	38.24	14	35	06.5	19.457 834	0.45	1.80	4	33	47
	22	2	33	37.09	+14	35	00.1	19.441 799	0.45	1.80	4	29	50
	23	2	33	35.76	14	34	52.8	19.425 858	0.45	1.80	4	25	53
	24	2	33	34.23	14	34	44.5	19.410 016	0.45	1.80	4	21	56
	25	2	33	32.51	14	34	35.4	19.394 277	0.45	1.81	4	17	58
	26	2	33	30.61	14	34	25.4	19.378 647	0.45	1.81	4	14	00
	27	2	33	28.52	14	34	14.5	19.363 128	0.45	1.81	4	10	02
	28	2	33	26.25	+14	34	02.7	19.347 727	0.45	1.81	4	06	04
	29	2	33	23.79	14	33	50.0	19.332 447	0.45	1.81	4	02	05
	30	2	33	21.13	14	33	36.5	19.317 293	0.46	1.81	3	58	07
	31	2	33	18.30	14	33	22.1	19.302 268	0.46	1.81	3	54	08
Sept.	1	2	33	15.27	14	33	06.8	19.287 378	0.46	1.82	3	50	09
	2	2	33	12.06	14	32	50.7	19.272 625	0.46	1.82	3	46	10
	3	2	33	08.66	+14	32	33.6	19.258 016	0.46	1.82	3	42	11
	4	2	33	05.08	14	32	15.7	19.243 553	0.46	1.82	3	38	11
	5	2	33	01.33	14	31	57.0	19.229 241	0.46	1.82	3	34	12
	6	2	32	57.39	14	31	37.3	19.215 085	0.46	1.82	3	30	12
	7	2	32	53.28	14	31	16.9	19.201 088	0.46	1.82	3	26	12
	8	2	32	49.00	14	30	55.6	19.187 256	0.46	1.83	3	22	12
	9	2	32	44.55	+14	30	33.6	19.173 592	0.46	1.83	3	18	11
	10	2	32	39.92	14	30	10.7	19.160 100	0.46	1.83	3	14	11
	11	2	32	35.13	14	29	47.0	19.146 786	0.46	1.83	3	10	10
	12	2	32	30.17	14	29	22.5	19.133 654	0.46	1.83	3	06	09
	13	2	32	25.04	14	28	57.3	19.120 708	0.46	1.83	3	02	08
	14	2	32	19.75	14	28	31.3	19.107 953	0.46	1.83	2	58	07
	15	2	32	14.29	+14	28	04.5	19.095 392	0.46	1.83	2	54	06
	16	2	32	08.66	14	27	36.9	19.083 032	0.46	1.84	2	50	04
	17	2	32	02.87	14	27	08.6	19.070 875	0.46	1.84	2	46	02
	18	2	31	56.92	14	26	39.4	19.058 927	0.46	1.84	2	42	00
	19	2	31	50.82	14	26	09.5	19.047 192	0.46	1.84	2	37	59
	20	2	31	44.57	14	25	38.9	19.035 674	0.46	1.84	2	33	56
	21	2	31	38.17	+14	25	07.6	19.024 377	0.46	1.84	2	29	54
	22	2	31	31.63	14	24	35.6	19.013 305	0.46	1.84	2	25	52
	23	2	31	24.95	14	24	02.9	19.002 461	0.46	1.84	2	21	49
	24	2	31	18.13	14	23	29.6	18.991 849	0.46	1.84	2	17	46
	25	2	31	11.18	14	22	55.7	18.981 471	0.46	1.84	2	13	44
	26	2	31	04.09	14	22	21.1	18.971 332	0.46	1.85	2	09	41
	27	2	30	56.86	+14	21	45.9	18.961 433	0.46	1.85	2	05	37
	28	2	30	49.50	14	21	10.1	18.951 779	0.46	1.85	2	01	34
	29	2	30	42.02	14	20	33.6	18.942 373	0.46	1.85	1	57	31
	30	2	30	34.41	14	19	56.6	18.933 216	0.46	1.85	1	53	27
Oct.	1	2	30	26.68	+14	19	18.9	18.924 313	0.46	1.85	1	49	24

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RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

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		h	m	s	°	'	"		"	"	h	m	s
Oct.	1	2	30	26.68	+14	19	18.9	18.924 313	0.46	1.85	1	49	24
	2	2	30	18.83	14	18	40.7	18.915 665	0.46	1.85	1	45	20
	3	2	30	10.87	14	18	02.0	18.907 276	0.47	1.85	1	41	16
	4	2	30	02.80	14	17	22.7	18.899 149	0.47	1.85	1	37	12
	5	2	29	54.62	14	16	42.9	18.891 287	0.47	1.85	1	33	08
	6	2	29	46.35	14	16	02.6	18.883 692	0.47	1.85	1	29	04
	7	2	29	37.97	+14	15	21.8	18.876 367	0.47	1.86	1	24	60
	8	2	29	29.50	14	14	40.6	18.869 314	0.47	1.86	1	20	56
	9	2	29	20.93	14	13	58.9	18.862 538	0.47	1.86	1	16	51
	10	2	29	12.28	14	13	16.9	18.856 039	0.47	1.86	1	12	47
	11	2	29	03.54	14	12	34.4	18.849 821	0.47	1.86	1	08	42
	12	2	28	54.71	14	11	51.5	18.843 887	0.47	1.86	1	04	37
	13	2	28	45.79	+14	11	08.1	18.838 239	0.47	1.86	1	00	32
	14	2	28	36.80	14	10	24.5	18.832 880	0.47	1.86	0	56	28
	15	2	28	27.73	14	09	40.4	18.827 812	0.47	1.86	0	52	23
	16	2	28	18.59	14	08	55.9	18.823 037	0.47	1.86	0	48	18
	17	2	28	09.39	14	08	11.2	18.818 558	0.47	1.86	0	44	13
	18	2	28	00.13	14	07	26.1	18.814 376	0.47	1.86	0	40	08
	19	2	27	50.82	+14	06	40.8	18.810 494	0.47	1.86	0	36	02
	20	2	27	41.47	14	05	55.3	18.806 911	0.47	1.86	0	31	57
	21	2	27	32.07	14	05	09.5	18.803 631	0.47	1.86	0	27	52
	22	2	27	22.62	14	04	23.6	18.800 654	0.47	1.86	0	23	47
	23	2	27	13.14	14	03	37.5	18.797 980	0.47	1.86	0	19	41
	24	2	27	03.61	14	02	51.2	18.795 610	0.47	1.86	0	15	36
	25	2	26	54.06	+14	02	04.7	18.793 546	0.47	1.86	0	11	30
	26	2	26	44.47	14	01	18.2	18.791 787	0.47	1.86	0	07	25
	27	2	26	34.86	14	00	31.4	18.790 334	0.47	1.86	0	03	20
	28	2	26	25.23	13	59	44.6	18.789 188	0.47	1.86	23	55	09
	29	2	26	15.58	13	58	57.7	18.788 348	0.47	1.86	23	51	03
	30	2	26	05.93	13	58	10.7	18.787 816	0.47	1.86	23	46	58
	31	2	25	56.27	+13	57	23.7	18.787 591	0.47	1.86	23	42	52
Nov.	1	2	25	46.60	13	56	36.7	18.787 675	0.47	1.86	23	38	47
	2	2	25	36.95	13	55	49.7	18.788 065	0.47	1.86	23	34	41
	3	2	25	27.30	13	55	02.8	18.788 764	0.47	1.86	23	30	36
	4	2	25	17.66	13	54	15.9	18.789 771	0.47	1.86	23	26	30
	5	2	25	08.04	13	53	29.1	18.791 087	0.47	1.86	23	22	25
	6	2	24	58.44	+13	52	42.4	18.792 710	0.47	1.86	23	18	19
	7	2	24	48.86	13	51	55.8	18.794 641	0.47	1.86	23	14	14
	8	2	24	39.30	13	51	09.3	18.796 879	0.47	1.86	23	10	08
	9	2	24	29.77	13	50	23.0	18.799 426	0.47	1.86	23	06	03
	10	2	24	20.27	13	49	36.9	18.802 279	0.47	1.86	23	01	58
	11	2	24	10.80	13	48	50.9	18.805 439	0.47	1.86	22	57	52
	12	2	24	01.38	+13	48	05.1	18.808 906	0.47	1.86	22	53	47
	13	2	23	52.01	13	47	19.5	18.812 678	0.47	1.86	22	49	42
	14	2	23	42.69	13	46	34.1	18.816 755	0.47	1.86	22	45	37
	15	2	23	33.43	13	45	49.1	18.821 135	0.47	1.86	22	41	32
	16	2	23	24.23	+13	45	04.3	18.825 817	0.47	1.86	22	37	27

URANUS, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Nov.	16	2	23	24.23	+13	45	04.3	18.825 817	0.47	1.86	22	37	27
	17	2	23	15.10	13	44	20.0	18.830 800	0.47	1.86	22	33	22
	18	2	23	06.05	13	43	35.9	18.836 082	0.47	1.86	22	29	17
	19	2	22	57.06	13	42	52.3	18.841 660	0.47	1.86	22	25	12
	20	2	22	48.15	13	42	09.1	18.847 532	0.47	1.86	22	21	08
	21	2	22	39.32	13	41	26.2	18.853 696	0.47	1.86	22	17	03
	22	2	22	30.57	+13	40	43.8	18.860 150	0.47	1.86	22	12	58
	23	2	22	21.90	13	40	01.7	18.866 892	0.47	1.86	22	08	54
	24	2	22	13.33	13	39	20.2	18.873 918	0.47	1.86	22	04	50
	25	2	22	04.85	13	38	39.1	18.881 226	0.47	1.85	22	00	45
	26	2	21	56.47	13	37	58.5	18.888 814	0.47	1.85	21	56	41
	27	2	21	48.20	13	37	18.4	18.896 679	0.47	1.85	21	52	37
	28	2	21	40.03	+13	36	38.8	18.904 818	0.47	1.85	21	48	33
	29	2	21	31.98	13	35	59.9	18.913 229	0.46	1.85	21	44	29
	30	2	21	24.04	13	35	21.5	18.921 908	0.46	1.85	21	40	26
Dec.	1	2	21	16.22	13	34	43.7	18.930 854	0.46	1.85	21	36	22
	2	2	21	08.53	13	34	06.5	18.940 063	0.46	1.85	21	32	19
	3	2	21	00.95	13	33	29.9	18.949 532	0.46	1.85	21	28	15
	4	2	20	53.51	+13	32	54.1	18.959 259	0.46	1.85	21	24	12
	5	2	20	46.19	13	32	18.8	18.969 240	0.46	1.85	21	20	09
	6	2	20	39.00	13	31	44.2	18.979 473	0.46	1.85	21	16	06
	7	2	20	31.94	13	31	10.3	18.989 954	0.46	1.84	21	12	03
	8	2	20	25.02	13	30	37.1	19.000 680	0.46	1.84	21	08	01
	9	2	20	18.23	13	30	04.6	19.011 648	0.46	1.84	21	03	58
	10	2	20	11.60	+13	29	32.8	19.022 856	0.46	1.84	20	59	56
	11	2	20	05.11	13	29	01.7	19.034 298	0.46	1.84	20	55	54
	12	2	19	58.78	13	28	31.4	19.045 972	0.46	1.84	20	51	51
	13	2	19	52.60	13	28	01.9	19.057 873	0.46	1.84	20	47	50
	14	2	19	46.59	13	27	33.2	19.069 998	0.46	1.84	20	43	48
	15	2	19	40.74	13	27	05.4	19.082 342	0.46	1.84	20	39	46
	16	2	19	35.05	+13	26	38.4	19.094 901	0.46	1.83	20	35	45
	17	2	19	29.53	13	26	12.2	19.107 669	0.46	1.83	20	31	43
	18	2	19	24.17	13	25	46.9	19.120 643	0.46	1.83	20	27	42
	19	2	19	18.98	13	25	22.5	19.133 818	0.46	1.83	20	23	41
	20	2	19	13.96	13	24	58.9	19.147 189	0.46	1.83	20	19	41
	21	2	19	09.11	13	24	36.2	19.160 751	0.46	1.83	20	15	40
	22	2	19	04.44	+13	24	14.4	19.174 498	0.46	1.83	20	11	40
	23	2	18	59.94	13	23	53.4	19.188 428	0.46	1.83	20	07	39
	24	2	18	55.62	13	23	33.4	19.202 534	0.46	1.82	20	03	39
	25	2	18	51.49	13	23	14.3	19.216 812	0.46	1.82	19	59	40
	26	2	18	47.55	13	22	56.2	19.231 258	0.46	1.82	19	55	40
	27	2	18	43.79	13	22	39.0	19.245 865	0.46	1.82	19	51	40
	28	2	18	40.22	+13	22	22.7	19.260 631	0.46	1.82	19	47	41
	29	2	18	36.84	13	22	07.5	19.275 549	0.46	1.82	19	43	42
	30	2	18	33.65	13	21	53.2	19.290 616	0.46	1.82	19	39	43
	31	2	18	30.65	13	21	39.9	19.305 826	0.46	1.81	19	35	44
	32	2	18	27.84	+13	21	27.6	19.321 175	0.46	1.81	19	31	46

NEPTUNE, 2020
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector	Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector
	° ' "	° ' "			° ' "	° ' "	
Jan. 1	347 59 44.9	-1 02 22.4	29.932 92	Apr. 2	348 33 19.5	-1 03 12.2	29.931 46
3	348 00 28.7	1 02 23.5	29.932 89	4	348 34 03.3	1 03 13.3	29.931 43
5	348 01 12.5	1 02 24.5	29.932 86	6	348 34 47.1	1 03 14.4	29.931 40
7	348 01 56.3	1 02 25.6	29.932 83	8	348 35 30.9	1 03 15.4	29.931 36
9	348 02 40.1	1 02 26.7	29.932 80	10	348 36 14.7	1 03 16.5	29.931 33
11	348 03 23.9	1 02 27.8	29.932 76	12	348 36 58.5	1 03 17.6	29.931 30
13	348 04 07.7	-1 02 28.9	29.932 73	14	348 37 42.3	-1 03 18.7	29.931 27
15	348 04 51.4	1 02 30.0	29.932 70	16	348 38 26.1	1 03 19.8	29.931 24
17	348 05 35.2	1 02 31.1	29.932 67	18	348 39 09.9	1 03 20.8	29.931 20
19	348 06 19.0	1 02 32.2	29.932 64	20	348 39 53.7	1 03 21.9	29.931 17
21	348 07 02.8	1 02 33.2	29.932 61	22	348 40 37.5	1 03 23.0	29.931 14
23	348 07 46.6	1 02 34.3	29.932 57	24	348 41 21.3	1 03 24.1	29.931 11
25	348 08 30.4	-1 02 35.4	29.932 54	26	348 42 05.2	-1 03 25.1	29.931 08
27	348 09 14.2	1 02 36.5	29.932 51	28	348 42 49.0	1 03 26.2	29.931 04
29	348 09 58.0	1 02 37.6	29.932 48	30	348 43 32.8	1 03 27.3	29.931 01
31	348 10 41.7	1 02 38.7	29.932 45	May 2	348 44 16.6	1 03 28.4	29.930 98
Feb. 2	348 11 25.5	1 02 39.8	29.932 41	4	348 45 00.4	1 03 29.4	29.930 95
4	348 12 09.3	1 02 40.8	29.932 38	6	348 45 44.2	1 03 30.5	29.930 92
6	348 12 53.1	-1 02 41.9	29.932 35	8	348 46 28.0	-1 03 31.6	29.930 88
8	348 13 36.9	1 02 43.0	29.932 32	10	348 47 11.8	1 03 32.7	29.930 85
10	348 14 20.7	1 02 44.1	29.932 29	12	348 47 55.6	1 03 33.7	29.930 82
12	348 15 04.5	1 02 45.2	29.932 26	14	348 48 39.4	1 03 34.8	29.930 79
14	348 15 48.3	1 02 46.3	29.932 22	16	348 49 23.2	1 03 35.9	29.930 76
16	348 16 32.1	1 02 47.3	29.932 19	18	348 50 07.1	1 03 37.0	29.930 73
18	348 17 15.9	-1 02 48.4	29.932 16	20	348 50 50.9	-1 03 38.1	29.930 69
20	348 17 59.7	1 02 49.5	29.932 13	22	348 51 34.7	1 03 39.1	29.930 66
22	348 18 43.5	1 02 50.6	29.932 10	24	348 52 18.5	1 03 40.2	29.930 63
24	348 19 27.3	1 02 51.7	29.932 06	26	348 53 02.3	1 03 41.3	29.930 60
26	348 20 11.1	1 02 52.7	29.932 03	28	348 53 46.1	1 03 42.4	29.930 57
28	348 20 54.9	1 02 53.8	29.932 00	30	348 54 29.9	1 03 43.4	29.930 53
Mar. 1	348 21 38.7	-1 02 54.9	29.931 97	June 1	348 55 13.7	-1 03 44.5	29.930 50
3	348 22 22.5	1 02 56.0	29.931 94	3	348 55 57.6	1 03 45.6	29.930 47
5	348 23 06.3	1 02 57.1	29.931 91	5	348 56 41.4	1 03 46.6	29.930 44
7	348 23 50.1	1 02 58.2	29.931 87	7	348 57 25.2	1 03 47.7	29.930 40
9	348 24 33.9	1 02 59.2	29.931 84	9	348 58 09.0	1 03 48.8	29.930 37
11	348 25 17.7	1 03 00.3	29.931 81	11	348 58 52.8	1 03 49.9	29.930 34
13	348 26 01.5	-1 03 01.4	29.931 78	13	348 59 36.6	-1 03 51.0	29.930 31
15	348 26 45.3	1 03 02.5	29.931 75	15	349 00 20.5	1 03 52.0	29.930 28
17	348 27 29.1	1 03 03.5	29.931 71	17	349 01 04.3	1 03 53.1	29.930 24
19	348 28 12.9	1 03 04.6	29.931 68	19	349 01 48.1	1 03 54.2	29.930 21
21	348 28 56.7	1 03 05.7	29.931 65	21	349 02 31.9	1 03 55.2	29.930 18
23	348 29 40.5	1 03 06.8	29.931 62	23	349 03 15.7	1 03 56.3	29.930 15
25	348 30 24.3	-1 03 07.9	29.931 59	25	349 03 59.6	-1 03 57.4	29.930 12
27	348 31 08.1	1 03 09.0	29.931 55	27	349 04 43.4	1 03 58.5	29.930 08
29	348 31 51.9	1 03 10.1	29.931 52	29	349 05 27.2	1 03 59.5	29.930 05
31	348 32 35.7	1 03 11.1	29.931 49	July 1	349 06 11.0	1 04 00.6	29.930 02
Apr. 2	348 33 19.5	-1 03 12.2	29.931 46	3	349 06 54.8	-1 04 01.7	29.929 99

NEPTUNE, 2020

HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude ° ' "	Heliocentric Latitude ° ' "	Radius Vector	Date		Heliocentric Longitude ° ' "	Heliocentric Latitude ° ' "	Radius Vector
July	1	349 06 11.0	-1 04 00.6	29.930 02	Oct.	1	349 39 47.2	-1 04 49.7	29.928 51
	3	349 06 54.8	1 04 01.7	29.929 99		3	349 40 31.1	1 04 50.8	29.928 48
	5	349 07 38.7	1 04 02.7	29.929 95		5	349 41 14.9	1 04 51.8	29.928 44
	7	349 08 22.5	1 04 03.8	29.929 92		7	349 41 58.7	1 04 52.9	29.928 41
	9	349 09 06.3	1 04 04.9	29.929 89		9	349 42 42.6	1 04 54.0	29.928 38
	11	349 09 50.2	1 04 05.9	29.929 86		11	349 43 26.4	1 04 55.0	29.928 34
	13	349 10 34.0	-1 04 07.0	29.929 83		13	349 44 10.2	-1 04 56.1	29.928 31
	15	349 11 17.8	1 04 08.1	29.929 79		15	349 44 54.1	1 04 57.2	29.928 28
	17	349 12 01.6	1 04 09.2	29.929 76		17	349 45 37.9	1 04 58.2	29.928 24
	19	349 12 45.4	1 04 10.2	29.929 73		19	349 46 21.8	1 04 59.3	29.928 21
	21	349 13 29.3	1 04 11.3	29.929 70		21	349 47 05.6	1 05 00.4	29.928 18
	23	349 14 13.1	1 04 12.4	29.929 66		23	349 47 49.5	1 05 01.4	29.928 14
	25	349 14 56.9	-1 04 13.5	29.929 63		25	349 48 33.3	-1 05 02.5	29.928 11
	27	349 15 40.7	1 04 14.5	29.929 60		27	349 49 17.1	1 05 03.5	29.928 08
	29	349 16 24.6	1 04 15.6	29.929 57		29	349 50 01.0	1 05 04.6	29.928 04
	31	349 17 08.4	1 04 16.7	29.929 53		31	349 50 44.8	1 05 05.6	29.928 01
Aug.	2	349 17 52.2	1 04 17.7	29.929 50	Nov.	2	349 51 28.7	1 05 06.7	29.927 98
	4	349 18 36.1	1 04 18.8	29.929 47		4	349 52 12.5	1 05 07.8	29.927 94
	6	349 19 19.9	-1 04 19.9	29.929 43		6	349 52 56.4	-1 05 08.8	29.927 91
	8	349 20 03.7	1 04 20.9	29.929 40		8	349 53 40.2	1 05 09.9	29.927 87
	10	349 20 47.5	1 04 22.0	29.929 37		10	349 54 24.0	1 05 11.0	29.927 84
	12	349 21 31.4	1 04 23.1	29.929 34		12	349 55 07.9	1 05 12.0	29.927 81
	14	349 22 15.2	1 04 24.1	29.929 30		14	349 55 51.7	1 05 13.1	29.927 77
	16	349 22 59.0	1 04 25.2	29.929 27		16	349 56 35.6	1 05 14.2	29.927 74
	18	349 23 42.8	-1 04 26.3	29.929 24		18	349 57 19.4	-1 05 15.2	29.927 71
	20	349 24 26.7	1 04 27.3	29.929 21		20	349 58 03.3	1 05 16.3	29.927 67
	22	349 25 10.5	1 04 28.4	29.929 17		22	349 58 47.1	1 05 17.3	29.927 64
	24	349 25 54.4	1 04 29.5	29.929 14		24	349 59 31.0	1 05 18.4	29.927 60
	26	349 26 38.2	1 04 30.5	29.929 11		26	350 00 14.8	1 05 19.4	29.927 57
	28	349 27 22.0	1 04 31.6	29.929 07		28	350 00 58.6	1 05 20.5	29.927 54
	30	349 28 05.9	-1 04 32.7	29.929 04		30	350 01 42.5	-1 05 21.6	29.927 50
Sept.	1	349 28 49.7	1 04 33.7	29.929 01	Dec.	2	350 02 26.3	1 05 22.6	29.927 47
	3	349 29 33.5	1 04 34.8	29.928 98		4	350 03 10.2	1 05 23.7	29.927 44
	5	349 30 17.4	1 04 35.9	29.928 94		6	350 03 54.1	1 05 24.7	29.927 40
	7	349 31 01.2	1 04 36.9	29.928 91		8	350 04 37.9	1 05 25.8	29.927 37
	9	349 31 45.0	1 04 38.0	29.928 88		10	350 05 21.7	1 05 26.8	29.927 33
	11	349 32 28.9	-1 04 39.1	29.928 84		12	350 06 05.6	-1 05 27.9	29.927 30
	13	349 33 12.7	1 04 40.1	29.928 81		14	350 06 49.4	1 05 29.0	29.927 27
	15	349 33 56.5	1 04 41.2	29.928 78		16	350 07 33.3	1 05 30.0	29.927 23
	17	349 34 40.4	1 04 42.3	29.928 74		18	350 08 17.1	1 05 31.1	29.927 20
	19	349 35 24.2	1 04 43.3	29.928 71		20	350 09 01.0	1 05 32.1	29.927 16
	21	349 36 08.1	1 04 44.4	29.928 68		22	350 09 44.8	1 05 33.2	29.927 13
	23	349 36 51.9	-1 04 45.4	29.928 64		24	350 10 28.7	-1 05 34.2	29.927 10
	25	349 37 35.7	1 04 46.5	29.928 61		26	350 11 12.6	1 05 35.3	29.927 06
	27	349 38 19.6	1 04 47.6	29.928 58		28	350 11 56.4	1 05 36.4	29.927 03
	29	349 39 03.4	1 04 48.6	29.928 54		30	350 12 40.3	1 05 37.4	29.926 99
Oct.	1	349 39 47.2	-1 04 49.7	29.928 51		32	350 13 24.1	-1 05 38.5	29.926 96

NEPTUNE, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Jan.	0	346	14	43.7	-1	01	36.9	Feb.	15	347	33	23.0	-1	00	55.2
	1	346	15	52.1	1	01	35.5		16	347	35	32.1	1	00	54.9
	2	346	17	02.4	1	01	34.1		17	347	37	41.9	1	00	54.7
	3	346	18	14.4	1	01	32.7		18	347	39	52.4	1	00	54.5
	4	346	19	28.2	1	01	31.3		19	347	42	03.6	1	00	54.4
	5	346	20	43.9	1	01	30.0		20	347	44	15.3	1	00	54.3
	6	346	22	01.3	-1	01	28.6		21	347	46	27.6	-1	00	54.2
	7	346	23	20.5	1	01	27.3		22	347	48	40.3	1	00	54.1
	8	346	24	41.5	1	01	26.0		23	347	50	53.5	1	00	54.1
	9	346	26	04.2	1	01	24.8		24	347	53	07.1	1	00	54.1
	10	346	27	28.6	1	01	23.5		25	347	55	21.2	1	00	54.2
	11	346	28	54.6	1	01	22.3		26	347	57	35.6	1	00	54.3
	12	346	30	22.3	-1	01	21.1		27	347	59	50.3	-1	00	54.4
	13	346	31	51.5	1	01	19.9		28	348	02	05.4	1	00	54.5
	14	346	33	22.3	1	01	18.7		29	348	04	20.8	1	00	54.7
	15	346	34	54.6	1	01	17.5	Mar.	1	348	06	36.5	1	00	54.9
	16	346	36	28.4	1	01	16.4		2	348	08	52.5	1	00	55.2
	17	346	38	03.7	1	01	15.3		3	348	11	08.7	1	00	55.4
	18	346	39	40.6	-1	01	14.2		4	348	13	25.2	-1	00	55.8
	19	346	41	19.0	1	01	13.2		5	348	15	41.8	1	00	56.1
	20	346	42	59.0	1	01	12.2		6	348	17	58.5	1	00	56.5
	21	346	44	40.4	1	01	11.2		7	348	20	15.2	1	00	57.0
	22	346	46	23.3	1	01	10.2		8	348	22	31.9	1	00	57.7
	23	346	48	07.5	1	01	09.3		9	348	24	48.2	1	00	58.2
	24	346	49	53.2	-1	01	08.3		10	348	27	04.8	-1	00	58.5
	25	346	51	40.1	1	01	07.4		11	348	29	21.3	1	00	59.0
	26	346	53	28.4	1	01	06.6		12	348	31	37.8	1	00	59.5
	27	346	55	17.8	1	01	05.7		13	348	33	54.3	1	01	00.1
	28	346	57	08.5	1	01	04.9		14	348	36	10.6	1	01	00.8
	29	346	59	00.4	1	01	04.1		15	348	38	26.9	1	01	01.5
	30	347	00	53.5	-1	01	03.4		16	348	40	43.0	-1	01	02.2
	31	347	02	47.7	1	01	02.6		17	348	42	58.9	1	01	02.9
Feb.	1	347	04	43.1	1	01	01.9		18	348	45	14.5	1	01	03.7
	2	347	06	39.6	1	01	01.2		19	348	47	29.8	1	01	04.6
	3	347	08	37.3	1	01	00.6		20	348	49	44.8	1	01	05.4
	4	347	10	36.0	1	01	00.0		21	348	51	59.4	1	01	06.3
	5	347	12	35.8	-1	00	59.4		22	348	54	13.6	-1	01	07.2
	6	347	14	36.7	1	00	58.8		23	348	56	27.3	1	01	08.2
	7	347	16	38.5	1	00	58.3		24	348	58	40.6	1	01	09.2
	8	347	18	41.2	1	00	57.8		25	349	00	53.5	1	01	10.2
	9	347	20	44.8	1	00	57.3		26	349	03	05.8	1	01	11.3
	10	347	22	49.2	1	00	56.9		27	349	05	17.6	1	01	12.3
	11	347	24	54.4	-1	00	56.5		28	349	07	28.9	-1	01	13.5
	12	347	27	00.3	1	00	56.1		29	349	09	39.6	1	01	14.6
	13	347	29	07.1	1	00	55.7		30	349	11	49.7	1	01	15.8
	14	347	31	14.7	1	00	55.4		31	349	13	59.3	1	01	17.0
	15	347	33	23.0	-1	00	55.2	Apr.	1	349	16	08.1	-1	01	18.3

NEPTUNE, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Apr.	1	349	16	08.1	-1	01	18.3	May	17	350	35	22.2	-1	02	46.0
	2	349	18	16.3	1	01	19.5		18	350	36	31.6	1	02	48.5
	3	349	20	23.7	1	01	20.8		19	350	37	39.3	1	02	50.9
	4	349	22	30.3	1	01	22.2		20	350	38	45.3	1	02	53.4
	5	349	24	36.1	1	01	23.6		21	350	39	49.5	1	02	55.9
	6	349	26	41.0	1	01	25.0		22	350	40	51.9	1	02	58.4
	7	349	28	45.0	-1	01	26.4		23	350	41	52.6	-1	03	00.9
	8	349	30	48.2	1	01	27.9		24	350	42	51.6	1	03	03.4
	9	349	32	50.5	1	01	29.4		25	350	43	48.7	1	03	06.0
	10	349	34	51.9	1	01	30.9		26	350	44	44.0	1	03	08.5
	11	349	36	52.5	1	01	32.5		27	350	45	37.4	1	03	11.1
	12	349	38	52.2	1	01	34.0		28	350	46	29.0	1	03	13.7
	13	349	40	50.8	-1	01	35.7		29	350	47	18.6	-1	03	16.3
	14	349	42	48.5	1	01	37.3		30	350	48	06.4	1	03	18.9
	15	349	44	45.2	1	01	39.0		31	350	48	52.2	1	03	21.5
	16	349	46	40.7	1	01	40.7	June	1	350	49	36.0	1	03	24.1
	17	349	48	35.1	1	01	42.4		2	350	50	18.0	1	03	26.7
	18	349	50	28.3	1	01	44.2		3	350	50	58.2	1	03	29.4
	19	349	52	20.3	-1	01	46.0		4	350	51	36.4	-1	03	32.0
	20	349	54	11.2	1	01	47.8		5	350	52	12.9	1	03	34.7
	21	349	56	00.8	1	01	49.7		6	350	52	47.4	1	03	37.4
	22	349	57	49.3	1	01	51.5		7	350	53	20.1	1	03	40.0
	23	349	59	36.5	1	01	53.4		8	350	53	50.9	1	03	42.7
	24	350	01	22.4	1	01	55.3		9	350	54	19.7	1	03	45.4
	25	350	03	07.1	-1	01	57.3		10	350	54	46.5	-1	03	48.1
	26	350	04	50.5	1	01	59.3		11	350	55	11.3	1	03	50.8
	27	350	06	32.7	1	02	01.3		12	350	55	34.2	1	03	53.5
	28	350	08	13.4	1	02	03.3		13	350	55	55.0	1	03	56.2
	29	350	09	52.8	1	02	05.3		14	350	56	13.9	1	03	58.9
	30	350	11	30.8	1	02	07.4		15	350	56	30.8	1	04	01.6
May	1	350	13	07.3	-1	02	09.5		16	350	56	45.7	-1	04	04.3
	2	350	14	42.3	1	02	11.6		17	350	56	58.8	1	04	07.0
	3	350	16	15.8	1	02	13.8		18	350	57	09.8	1	04	09.7
	4	350	17	47.8	1	02	15.9		19	350	57	19.0	1	04	12.4
	5	350	19	18.3	1	02	18.1		20	350	57	26.2	1	04	15.1
	6	350	20	47.2	1	02	20.3		21	350	57	31.5	1	04	17.8
	7	350	22	14.7	-1	02	22.6		22	350	57	34.8	-1	04	20.5
	8	350	23	40.7	1	02	24.8		23	350	57	36.2	1	04	23.1
	9	350	25	05.1	1	02	27.1		24	350	57	35.6	1	04	25.8
	10	350	26	28.1	1	02	29.4		25	350	57	33.0	1	04	28.5
	11	350	27	49.4	1	02	31.7		26	350	57	28.3	1	04	31.2
	12	350	29	09.1	1	02	34.0		27	350	57	21.7	1	04	33.8
	13	350	30	27.2	-1	02	36.4		28	350	57	13.1	-1	04	36.5
	14	350	31	43.5	1	02	38.8		29	350	57	02.6	1	04	39.2
	15	350	32	58.1	1	02	41.2		30	350	56	50.2	1	04	41.8
	16	350	34	11.0	1	02	43.6	July	1	350	56	35.9	1	04	44.5
	17	350	35	22.2	-1	02	46.0		2	350	56	19.8	-1	04	47.1

NEPTUNE, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
July	1	350	56	35.9	-1	04	44.5	Aug.	16	350	15	08.5	-1	06	26.0
	2	350	56	19.8	1	04	47.1		17	350	13	42.3	1	06	27.5
	3	350	56	01.8	1	04	49.7		18	350	12	15.2	1	06	29.0
	4	350	55	42.0	1	04	52.3		19	350	10	47.1	1	06	30.5
	5	350	55	20.4	1	04	54.9		20	350	09	18.0	1	06	32.0
	6	350	54	56.8	1	04	57.5		21	350	07	48.1	1	06	33.4
	7	350	54	31.4	-1	05	00.1		22	350	06	17.3	-1	06	34.7
	8	350	54	04.0	1	05	02.7		23	350	04	45.8	1	06	36.1
	9	350	53	34.8	1	05	05.2		24	350	03	13.5	1	06	37.4
	10	350	53	03.7	1	05	07.8		25	350	01	40.7	1	06	38.6
	11	350	52	30.8	1	05	10.3		26	350	00	07.2	1	06	39.9
	12	350	51	56.1	1	05	12.8		27	349	58	33.2	1	06	41.0
	13	350	51	19.5	-1	05	15.3		28	349	56	58.5	-1	06	42.2
	14	350	50	41.2	1	05	17.7		29	349	55	23.4	1	06	43.3
	15	350	50	01.2	1	05	20.2		30	349	53	47.7	1	06	44.4
	16	350	49	19.5	1	05	22.6		31	349	52	11.4	1	06	45.4
	17	350	48	36.0	1	05	25.0	Sept.	1	349	50	34.7	1	06	46.4
	18	350	47	50.9	1	05	27.4		2	349	48	57.6	1	06	47.3
	19	350	47	04.1	-1	05	29.8		3	349	47	20.0	-1	06	48.2
	20	350	46	15.6	1	05	32.2		4	349	45	42.0	1	06	49.1
	21	350	45	25.4	1	05	34.5		5	349	44	03.8	1	06	49.9
	22	350	44	33.6	1	05	36.8		6	349	42	25.3	1	06	50.7
	23	350	43	40.0	1	05	39.1		7	349	40	46.6	1	06	51.5
	24	350	42	44.8	1	05	41.4		8	349	39	07.7	1	06	52.2
	25	350	41	47.9	-1	05	43.6		9	349	37	28.7	-1	06	52.8
	26	350	40	49.5	1	05	45.8		10	349	35	49.6	1	06	53.4
	27	350	39	49.6	1	05	48.0		11	349	34	10.5	1	06	54.0
	28	350	38	48.2	1	05	50.2		12	349	32	31.3	1	06	54.5
	29	350	37	45.4	1	05	52.3		13	349	30	52.1	1	06	55.0
	30	350	36	41.1	1	05	54.5		14	349	29	13.0	1	06	55.5
	31	350	35	35.5	-1	05	56.6		15	349	27	33.8	-1	06	55.9
Aug.	1	350	34	28.4	1	05	58.6		16	349	25	54.7	1	06	56.3
	2	350	33	20.0	1	06	00.7		17	349	24	15.8	1	06	56.6
	3	350	32	10.2	1	06	02.7		18	349	22	36.9	1	06	56.9
	4	350	30	59.0	1	06	04.7		19	349	20	58.3	1	06	57.1
	5	350	29	46.4	1	06	06.6		20	349	19	20.0	1	06	57.3
	6	350	28	32.5	-1	06	08.5		21	349	17	42.1	-1	06	57.5
	7	350	27	17.3	1	06	10.4		22	349	16	04.6	1	06	57.6
	8	350	26	00.8	1	06	12.3		23	349	14	27.6	1	06	57.7
	9	350	24	43.1	1	06	14.1		24	349	12	51.0	1	06	57.7
	10	350	23	24.3	1	06	15.9		25	349	11	14.9	1	06	57.7
	11	350	22	04.3	1	06	17.7		26	349	09	39.3	1	06	57.7
	12	350	20	43.2	-1	06	19.4		27	349	08	04.2	-1	06	57.6
	13	350	19	21.1	1	06	21.1		28	349	06	29.6	1	06	57.5
	14	350	17	57.9	1	06	22.7		29	349	04	55.6	1	06	57.3
	15	350	16	33.7	1	06	24.4		30	349	03	22.2	1	06	57.1
	16	350	15	08.5	-1	06	26.0	Oct.	1	349	01	49.5	-1	06	56.9

NEPTUNE, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Oct.	1	349	01	49.5	-1	06	56.9	Nov.	16	348	12	38.6	-1	06	09.8
	2	349	00	17.5	1	06	56.6		17	348	12	13.3	1	06	08.2
	3	348	58	46.3	1	06	56.3		18	348	11	50.0	1	06	06.6
	4	348	57	15.8	1	06	55.9		19	348	11	28.6	1	06	05.0
	5	348	55	46.3	1	06	55.5		20	348	11	09.3	1	06	03.4
	6	348	54	17.6	1	06	55.1		21	348	10	51.9	1	06	01.7
	7	348	52	49.9	-1	06	54.6		22	348	10	36.5	-1	06	00.0
	8	348	51	23.1	1	06	54.1		23	348	10	23.1	1	05	58.4
	9	348	49	57.3	1	06	53.6		24	348	10	11.6	1	05	56.7
	10	348	48	32.6	1	06	53.0		25	348	10	02.2	1	05	55.0
	11	348	47	08.8	1	06	52.3		26	348	09	54.9	1	05	53.3
	12	348	45	46.1	1	06	51.7		27	348	09	49.6	1	05	51.6
	13	348	44	24.5	-1	06	51.0		28	348	09	46.4	-1	05	49.8
	14	348	43	03.9	1	06	50.3		29	348	09	45.3	1	05	48.1
	15	348	41	44.5	1	06	49.5		30	348	09	46.3	1	05	46.4
	16	348	40	26.2	1	06	48.7	Dec.	1	348	09	49.4	1	05	44.6
	17	348	39	09.2	1	06	47.9		2	348	09	54.6	1	05	42.9
	18	348	37	53.6	1	06	47.0		3	348	10	01.9	1	05	41.1
	19	348	36	39.3	-1	06	46.1		4	348	10	11.2	-1	05	39.4
	20	348	35	26.4	1	06	45.2		5	348	10	22.6	1	05	37.6
	21	348	34	15.0	1	06	44.2		6	348	10	36.1	1	05	35.9
	22	348	33	05.0	1	06	43.2		7	348	10	51.6	1	05	34.1
	23	348	31	56.4	1	06	42.2		8	348	11	09.1	1	05	32.4
	24	348	30	49.2	1	06	41.2		9	348	11	28.6	1	05	30.6
	25	348	29	43.4	-1	06	40.1		10	348	11	50.3	-1	05	28.9
	26	348	28	39.1	1	06	39.0		11	348	12	14.0	1	05	27.1
	27	348	27	36.3	1	06	37.8		12	348	12	39.9	1	05	25.4
	28	348	26	35.0	1	06	36.6		13	348	13	07.9	1	05	23.6
	29	348	25	35.4	1	06	35.4		14	348	13	38.1	1	05	21.9
	30	348	24	37.3	1	06	34.2		15	348	14	10.4	1	05	20.2
	31	348	23	40.9	-1	06	33.0		16	348	14	44.7	-1	05	18.4
Nov.	1	348	22	46.1	1	06	31.7		17	348	15	21.1	1	05	16.7
	2	348	21	53.1	1	06	30.4		18	348	15	59.5	1	05	15.0
	3	348	21	01.8	1	06	29.0		19	348	16	39.9	1	05	13.3
	4	348	20	12.2	1	06	27.7		20	348	17	22.2	1	05	11.6
	5	348	19	24.5	1	06	26.3		21	348	18	06.5	1	05	09.9
	6	348	18	38.5	-1	06	24.9		22	348	18	52.8	-1	05	08.2
	7	348	17	54.2	1	06	23.5		23	348	19	41.1	1	05	06.6
	8	348	17	11.8	1	06	22.0		24	348	20	31.4	1	05	04.9
	9	348	16	31.1	1	06	20.6		25	348	21	23.7	1	05	03.2
	10	348	15	52.2	1	06	19.1		26	348	22	18.0	1	05	01.6
	11	348	15	15.1	1	06	17.6		27	348	23	14.2	1	05	00.0
	12	348	14	39.9	-1	06	16.1		28	348	24	12.4	-1	04	58.3
	13	348	14	06.6	1	06	14.5		29	348	25	12.6	1	04	56.7
	14	348	13	35.2	1	06	13.0		30	348	26	14.6	1	04	55.2
	15	348	13	05.9	1	06	11.4		31	348	27	18.6	1	04	53.6
	16	348	12	38.6	-1	06	09.8		32	348	28	24.4	-1	04	52.0

NEPTUNE, 2020
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Jan.	0	23	10	58.33	-6	22	21.2	30.299 337	0.29	1.11	16	31	47
	1	23	11	02.52	6	21	53.3	30.315 289	0.29	1.11	16	27	55
	2	23	11	06.82	6	21	24.8	30.331 119	0.29	1.10	16	24	03
	3	23	11	11.24	6	20	55.5	30.346 822	0.29	1.10	16	20	12
	4	23	11	15.76	6	20	25.5	30.362 395	0.29	1.10	16	16	21
	5	23	11	20.40	6	19	54.9	30.377 833	0.29	1.10	16	12	29
	6	23	11	25.15	-6	19	23.5	30.393 131	0.29	1.10	16	08	38
	7	23	11	30.01	6	18	51.5	30.408 286	0.29	1.10	16	04	47
	8	23	11	34.98	6	18	18.9	30.423 292	0.29	1.10	16	00	56
	9	23	11	40.05	6	17	45.5	30.438 146	0.29	1.10	15	57	06
	10	23	11	45.23	6	17	11.5	30.452 844	0.29	1.10	15	53	15
	11	23	11	50.52	6	16	36.9	30.467 382	0.29	1.10	15	49	24
	12	23	11	55.90	-6	16	01.7	30.481 757	0.29	1.10	15	45	34
	13	23	12	01.38	6	15	25.9	30.495 964	0.29	1.10	15	41	43
	14	23	12	06.96	6	14	49.6	30.509 999	0.29	1.10	15	37	53
	15	23	12	12.63	6	14	12.6	30.523 860	0.29	1.10	15	34	03
	16	23	12	18.40	6	13	35.1	30.537 541	0.29	1.10	15	30	13
	17	23	12	24.26	6	12	57.0	30.551 038	0.29	1.10	15	26	23
	18	23	12	30.21	-6	12	18.3	30.564 348	0.29	1.10	15	22	33
	19	23	12	36.26	6	11	39.0	30.577 467	0.29	1.10	15	18	43
	20	23	12	42.41	6	10	59.1	30.590 390	0.29	1.10	15	14	53
	21	23	12	48.65	6	10	18.7	30.603 114	0.29	1.09	15	11	04
	22	23	12	54.97	6	09	37.8	30.615 633	0.29	1.09	15	07	14
	23	23	13	01.39	6	08	56.3	30.627 946	0.29	1.09	15	03	25
	24	23	13	07.89	-6	08	14.3	30.640 047	0.29	1.09	14	59	35
	25	23	13	14.47	6	07	31.9	30.651 933	0.29	1.09	14	55	46
	26	23	13	21.13	6	06	48.9	30.663 600	0.29	1.09	14	51	57
	27	23	13	27.86	6	06	05.5	30.675 045	0.29	1.09	14	48	07
	28	23	13	34.68	6	05	21.6	30.686 265	0.29	1.09	14	44	18
	29	23	13	41.56	6	04	37.3	30.697 256	0.29	1.09	14	40	29
	30	23	13	48.52	-6	03	52.6	30.708 016	0.29	1.09	14	36	40
	31	23	13	55.56	6	03	07.4	30.718 542	0.29	1.09	14	32	52
Feb.	1	23	14	02.66	6	02	21.8	30.728 830	0.29	1.09	14	29	03
	2	23	14	09.84	6	01	35.7	30.738 879	0.29	1.09	14	25	14
	3	23	14	17.08	6	00	49.3	30.748 685	0.29	1.09	14	21	25
	4	23	14	24.39	6	00	02.4	30.758 246	0.29	1.09	14	17	37
	5	23	14	31.77	-5	59	15.1	30.767 560	0.29	1.09	14	13	48
	6	23	14	39.21	5	58	27.5	30.776 625	0.29	1.09	14	09	60
	7	23	14	46.72	5	57	39.5	30.785 439	0.29	1.09	14	06	11
	8	23	14	54.28	5	56	51.2	30.794 000	0.29	1.09	14	02	23
	9	23	15	01.89	5	56	02.6	30.802 306	0.29	1.09	13	58	35
	10	23	15	09.56	5	55	13.6	30.810 354	0.29	1.09	13	54	46
	11	23	15	17.27	-5	54	24.4	30.818 144	0.29	1.09	13	50	58
	12	23	15	25.03	5	53	34.9	30.825 673	0.29	1.09	13	47	10
	13	23	15	32.85	5	52	45.2	30.832 939	0.29	1.09	13	43	22
	14	23	15	40.71	5	51	55.1	30.839 940	0.29	1.09	13	39	34
	15	23	15	48.62	-5	51	04.7	30.846 675	0.29	1.09	13	35	46

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RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Feb.	15	23	15	48.62	-5	51	04.7	30.846 675	0.29	1.09	13	35	46
	16	23	15	56.57	5	50	14.1	30.853 140	0.29	1.09	13	31	58
	17	23	16	04.58	5	49	23.2	30.859 334	0.28	1.09	13	28	10
	18	23	16	12.62	5	48	32.1	30.865 255	0.28	1.09	13	24	22
	19	23	16	20.71	5	47	40.8	30.870 902	0.28	1.09	13	20	34
	20	23	16	28.83	5	46	49.2	30.876 272	0.28	1.08	13	16	46
	21	23	16	36.98	-5	45	57.5	30.881 363	0.28	1.08	13	12	59
	22	23	16	45.17	5	45	05.6	30.886 176	0.28	1.08	13	09	11
	23	23	16	53.38	5	44	13.5	30.890 707	0.28	1.08	13	05	23
	24	23	17	01.62	5	43	21.4	30.894 956	0.28	1.08	13	01	35
	25	23	17	09.89	5	42	29.0	30.898 922	0.28	1.08	12	57	48
	26	23	17	18.18	5	41	36.6	30.902 603	0.28	1.08	12	54	00
	27	23	17	26.49	-5	40	44.0	30.906 000	0.28	1.08	12	50	13
	28	23	17	34.82	5	39	51.4	30.909 112	0.28	1.08	12	46	25
	29	23	17	43.17	5	38	58.6	30.911 937	0.28	1.08	12	42	37
Mar.	1	23	17	51.55	5	38	05.7	30.914 476	0.28	1.08	12	38	50
	2	23	17	59.93	5	37	12.8	30.916 728	0.28	1.08	12	35	02
	3	23	18	08.34	5	36	19.7	30.918 694	0.28	1.08	12	31	15
	4	23	18	16.76	-5	35	26.7	30.920 373	0.28	1.08	12	27	27
	5	23	18	25.18	5	34	33.6	30.921 765	0.28	1.08	12	23	40
	6	23	18	33.62	5	33	40.5	30.922 871	0.28	1.08	12	19	52
	7	23	18	42.06	5	32	47.4	30.923 691	0.28	1.08	12	16	05
	8	23	18	50.50	5	31	54.6	30.924 225	0.28	1.08	12	12	17
	9	23	18	58.92	5	31	01.7	30.924 474	0.28	1.08	12	08	30
	10	23	19	07.34	-5	30	08.5	30.924 438	0.28	1.08	12	04	42
	11	23	19	15.77	5	29	15.5	30.924 117	0.28	1.08	12	00	54
	12	23	19	24.19	5	28	22.6	30.923 511	0.28	1.08	11	57	07
	13	23	19	32.61	5	27	29.7	30.922 621	0.28	1.08	11	53	19
	14	23	19	41.03	5	26	36.9	30.921 446	0.28	1.08	11	49	32
	15	23	19	49.44	5	25	44.2	30.919 988	0.28	1.08	11	45	44
	16	23	19	57.85	-5	24	51.5	30.918 245	0.28	1.08	11	41	57
	17	23	20	06.24	5	23	59.0	30.916 219	0.28	1.08	11	38	09
	18	23	20	14.61	5	23	06.6	30.913 909	0.28	1.08	11	34	22
	19	23	20	22.97	5	22	14.3	30.911 317	0.28	1.08	11	30	34
	20	23	20	31.31	5	21	22.2	30.908 443	0.28	1.08	11	26	46
	21	23	20	39.62	5	20	30.3	30.905 287	0.28	1.08	11	22	59
	22	23	20	47.91	-5	19	38.6	30.901 851	0.28	1.08	11	19	11
	23	23	20	56.17	5	18	47.1	30.898 136	0.28	1.08	11	15	23
	24	23	21	04.41	5	17	55.7	30.894 143	0.28	1.08	11	11	36
	25	23	21	12.61	5	17	04.6	30.889 874	0.28	1.08	11	07	48
	26	23	21	20.79	5	16	13.7	30.885 329	0.28	1.08	11	04	00
	27	23	21	28.93	5	15	23.0	30.880 511	0.28	1.08	11	00	12
	28	23	21	37.05	-5	14	32.5	30.875 420	0.28	1.09	10	56	24
	29	23	21	45.13	5	13	42.3	30.870 060	0.28	1.09	10	52	37
	30	23	21	53.17	5	12	52.4	30.864 431	0.28	1.09	10	48	49
	31	23	22	01.18	5	12	02.7	30.858 537	0.28	1.09	10	45	01
Apr.	1	23	22	09.14	-5	11	13.2	30.852 378	0.29	1.09	10	41	13

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Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Apr.	1	23	22	09.14	-5	11	13.2	30.852 378	0.29	1.09	10	41	13
	2	23	22	17.07	5	10	24.1	30.845 958	0.29	1.09	10	37	25
	3	23	22	24.94	5	09	35.3	30.839 278	0.29	1.09	10	33	36
	4	23	22	32.77	5	08	46.9	30.832 341	0.29	1.09	10	29	48
	5	23	22	40.55	5	07	58.8	30.825 149	0.29	1.09	10	26	00
	6	23	22	48.28	5	07	11.1	30.817 705	0.29	1.09	10	22	12
	7	23	22	55.95	-5	06	23.7	30.810 011	0.29	1.09	10	18	24
	8	23	23	03.57	5	05	36.7	30.802 069	0.29	1.09	10	14	35
	9	23	23	11.13	5	04	50.1	30.793 881	0.29	1.09	10	10	47
	10	23	23	18.65	5	04	03.8	30.785 450	0.29	1.09	10	06	58
	11	23	23	26.11	5	03	17.9	30.776 778	0.29	1.09	10	03	10
	12	23	23	33.51	5	02	32.4	30.767 866	0.29	1.09	9	59	21
	13	23	23	40.86	-5	01	47.2	30.758 717	0.29	1.09	9	55	33
	14	23	23	48.14	5	01	02.5	30.749 333	0.29	1.09	9	51	44
	15	23	23	55.36	5	00	18.3	30.739 716	0.29	1.09	9	47	55
	16	23	24	02.52	4	59	34.5	30.729 869	0.29	1.09	9	44	06
	17	23	24	09.60	4	58	51.1	30.719 794	0.29	1.09	9	40	18
	18	23	24	16.61	4	58	08.3	30.709 495	0.29	1.09	9	36	29
	19	23	24	23.55	-4	57	25.9	30.698 973	0.29	1.09	9	32	40
	20	23	24	30.42	4	56	44.0	30.688 233	0.29	1.09	9	28	50
	21	23	24	37.22	4	56	02.6	30.677 276	0.29	1.09	9	25	01
	22	23	24	43.94	4	55	21.7	30.666 107	0.29	1.09	9	21	12
	23	23	24	50.58	4	54	41.3	30.654 728	0.29	1.09	9	17	23
	24	23	24	57.15	4	54	01.4	30.643 142	0.29	1.09	9	13	33
	25	23	25	03.64	-4	53	22.0	30.631 354	0.29	1.09	9	09	44
	26	23	25	10.05	4	52	43.2	30.619 367	0.29	1.09	9	05	54
	27	23	25	16.39	4	52	04.9	30.607 184	0.29	1.09	9	02	05
	28	23	25	22.64	4	51	27.1	30.594 810	0.29	1.09	8	58	15
	29	23	25	28.80	4	50	49.9	30.582 247	0.29	1.10	8	54	25
	30	23	25	34.88	4	50	13.3	30.569 501	0.29	1.10	8	50	35
May	1	23	25	40.88	-4	49	37.2	30.556 574	0.29	1.10	8	46	45
	2	23	25	46.77	4	49	01.8	30.543 470	0.29	1.10	8	42	55
	3	23	25	52.58	4	48	27.0	30.530 195	0.29	1.10	8	39	05
	4	23	25	58.29	4	47	52.8	30.516 750	0.29	1.10	8	35	15
	5	23	26	03.91	4	47	19.3	30.503 141	0.29	1.10	8	31	24
	6	23	26	09.44	4	46	46.3	30.489 371	0.29	1.10	8	27	34
	7	23	26	14.88	-4	46	13.9	30.475 443	0.29	1.10	8	23	43
	8	23	26	20.23	4	45	42.2	30.461 361	0.29	1.10	8	19	53
	9	23	26	25.48	4	45	11.0	30.447 128	0.29	1.10	8	16	02
	10	23	26	30.64	4	44	40.5	30.432 749	0.29	1.10	8	12	11
	11	23	26	35.70	4	44	10.6	30.418 226	0.29	1.10	8	08	20
	12	23	26	40.66	4	43	41.4	30.403 562	0.29	1.10	8	04	29
	13	23	26	45.53	-4	43	12.9	30.388 763	0.29	1.10	8	00	38
	14	23	26	50.28	4	42	45.0	30.373 831	0.29	1.10	7	56	47
	15	23	26	54.93	4	42	17.8	30.358 771	0.29	1.10	7	52	56
	16	23	26	59.48	4	41	51.4	30.343 586	0.29	1.10	7	49	04
	17	23	27	03.92	-4	41	25.6	30.328 281	0.29	1.10	7	45	13

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Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
May	17	23	27	03.92	-4	41	25.6	30.328 281	0.29	1.10	7	45	13
	18	23	27	08.25	4	41	00.5	30.312 860	0.29	1.11	7	41	21
	19	23	27	12.48	4	40	36.1	30.297 327	0.29	1.11	7	37	29
	20	23	27	16.60	4	40	12.4	30.281 686	0.29	1.11	7	33	37
	21	23	27	20.61	4	39	49.4	30.265 942	0.29	1.11	7	29	46
	22	23	27	24.51	4	39	27.1	30.250 100	0.29	1.11	7	25	53
	23	23	27	28.31	-4	39	05.5	30.234 165	0.29	1.11	7	22	01
	24	23	27	32.00	4	38	44.7	30.218 140	0.29	1.11	7	18	09
	25	23	27	35.58	4	38	24.5	30.202 030	0.29	1.11	7	14	17
	26	23	27	39.04	4	38	05.1	30.185 841	0.29	1.11	7	10	24
	27	23	27	42.40	4	37	46.4	30.169 577	0.29	1.11	7	06	32
	28	23	27	45.63	4	37	28.5	30.153 243	0.29	1.11	7	02	39
	29	23	27	48.75	-4	37	11.3	30.136 844	0.29	1.11	6	58	46
	30	23	27	51.76	4	36	54.9	30.120 385	0.29	1.11	6	54	53
	31	23	27	54.64	4	36	39.3	30.103 869	0.29	1.11	6	50	60
June	1	23	27	57.41	4	36	24.4	30.087 303	0.29	1.11	6	47	07
	2	23	28	00.06	4	36	10.3	30.070 690	0.29	1.11	6	43	13
	3	23	28	02.59	4	35	56.9	30.054 035	0.29	1.11	6	39	20
	4	23	28	05.02	-4	35	44.3	30.037 343	0.29	1.12	6	35	26
	5	23	28	07.32	4	35	32.3	30.020 616	0.29	1.12	6	31	33
	6	23	28	09.52	4	35	21.2	30.003 861	0.29	1.12	6	27	39
	7	23	28	11.60	4	35	10.7	29.987 080	0.29	1.12	6	23	45
	8	23	28	13.56	4	35	01.1	29.970 278	0.29	1.12	6	19	51
	9	23	28	15.40	4	34	52.2	29.953 460	0.29	1.12	6	15	57
	10	23	28	17.12	-4	34	44.1	29.936 630	0.29	1.12	6	12	03
	11	23	28	18.72	4	34	36.8	29.919 792	0.29	1.12	6	08	08
	12	23	28	20.19	4	34	30.3	29.902 950	0.29	1.12	6	04	14
	13	23	28	21.54	4	34	24.6	29.886 110	0.29	1.12	6	00	19
	14	23	28	22.77	4	34	19.6	29.869 276	0.29	1.12	5	56	25
	15	23	28	23.89	4	34	15.5	29.852 453	0.29	1.12	5	52	30
	16	23	28	24.88	-4	34	12.1	29.835 645	0.29	1.12	5	48	35
	17	23	28	25.75	4	34	09.4	29.818 858	0.29	1.12	5	44	40
	18	23	28	26.50	4	34	07.5	29.802 096	0.30	1.12	5	40	45
	19	23	28	27.13	4	34	06.4	29.785 364	0.30	1.12	5	36	49
	20	23	28	27.65	4	34	06.0	29.768 668	0.30	1.13	5	32	54
	21	23	28	28.04	4	34	06.4	29.752 011	0.30	1.13	5	28	58
	22	23	28	28.32	-4	34	07.6	29.735 401	0.30	1.13	5	25	03
	23	23	28	28.47	4	34	09.5	29.718 840	0.30	1.13	5	21	07
	24	23	28	28.51	4	34	12.2	29.702 335	0.30	1.13	5	17	11
	25	23	28	28.42	4	34	15.7	29.685 890	0.30	1.13	5	13	15
	26	23	28	28.20	4	34	20.0	29.669 511	0.30	1.13	5	09	19
	27	23	28	27.87	4	34	25.1	29.653 202	0.30	1.13	5	05	23
	28	23	28	27.41	-4	34	30.9	29.636 968	0.30	1.13	5	01	26
	29	23	28	26.83	4	34	37.5	29.620 813	0.30	1.13	4	57	30
	30	23	28	26.14	4	34	44.8	29.604 742	0.30	1.13	4	53	33
July	1	23	28	25.33	4	34	52.9	29.588 760	0.30	1.13	4	49	36
	2	23	28	24.41	-4	35	01.6	29.572 870	0.30	1.13	4	45	39

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RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
July	1	23	28	25.33	-4	34	52.9	29.588 760	0.30	1.13	4	49	36
	2	23	28	24.41	4	35	01.6	29.572 870	0.30	1.13	4	45	39
	3	23	28	23.37	4	35	11.1	29.557 077	0.30	1.13	4	41	42
	4	23	28	22.22	4	35	21.3	29.541 385	0.30	1.13	4	37	45
	5	23	28	20.96	4	35	32.2	29.525 798	0.30	1.13	4	33	48
	6	23	28	19.58	4	35	43.9	29.510 320	0.30	1.14	4	29	51
	7	23	28	18.09	-4	35	56.3	29.494 955	0.30	1.14	4	25	53
	8	23	28	16.48	4	36	09.4	29.479 708	0.30	1.14	4	21	56
	9	23	28	14.75	4	36	23.3	29.464 582	0.30	1.14	4	17	58
	10	23	28	12.90	4	36	37.9	29.449 583	0.30	1.14	4	14	01
	11	23	28	10.95	4	36	53.2	29.434 713	0.30	1.14	4	10	03
	12	23	28	08.88	4	37	09.2	29.419 978	0.30	1.14	4	06	05
	13	23	28	06.70	-4	37	25.8	29.405 383	0.30	1.14	4	02	07
	14	23	28	04.41	4	37	43.2	29.390 930	0.30	1.14	3	58	08
	15	23	28	02.01	4	38	01.2	29.376 626	0.30	1.14	3	54	10
	16	23	27	59.51	4	38	19.9	29.362 474	0.30	1.14	3	50	12
	17	23	27	56.91	4	38	39.2	29.348 479	0.30	1.14	3	46	13
	18	23	27	54.20	4	38	59.2	29.334 645	0.30	1.14	3	42	15
	19	23	27	51.38	-4	39	19.8	29.320 976	0.30	1.14	3	38	16
	20	23	27	48.46	4	39	41.1	29.307 478	0.30	1.14	3	34	17
	21	23	27	45.44	4	40	03.0	29.294 154	0.30	1.14	3	30	18
	22	23	27	42.31	4	40	25.5	29.281 010	0.30	1.14	3	26	19
	23	23	27	39.08	4	40	48.8	29.268 048	0.30	1.14	3	22	20
	24	23	27	35.75	4	41	12.6	29.255 273	0.30	1.15	3	18	21
	25	23	27	32.31	-4	41	37.0	29.242 690	0.30	1.15	3	14	21
	26	23	27	28.78	4	42	02.1	29.230 301	0.30	1.15	3	10	22
	27	23	27	25.15	4	42	27.7	29.218 112	0.30	1.15	3	06	22
	28	23	27	21.43	4	42	53.9	29.206 124	0.30	1.15	3	02	23
	29	23	27	17.63	4	43	20.6	29.194 342	0.30	1.15	2	58	23
	30	23	27	13.73	4	43	47.8	29.182 768	0.30	1.15	2	54	23
	31	23	27	09.75	-4	44	15.6	29.171 406	0.30	1.15	2	50	23
Aug.	1	23	27	05.69	4	44	43.9	29.160 260	0.30	1.15	2	46	23
	2	23	27	01.53	4	45	12.7	29.149 331	0.30	1.15	2	42	23
	3	23	26	57.29	4	45	42.0	29.138 623	0.30	1.15	2	38	23
	4	23	26	52.97	4	46	11.9	29.128 139	0.30	1.15	2	34	23
	5	23	26	48.56	4	46	42.3	29.117 883	0.30	1.15	2	30	23
	6	23	26	44.06	-4	47	13.1	29.107 856	0.30	1.15	2	26	22
	7	23	26	39.49	4	47	44.5	29.098 063	0.30	1.15	2	22	22
	8	23	26	34.84	4	48	16.3	29.088 506	0.30	1.15	2	18	21
	9	23	26	30.11	4	48	48.5	29.079 188	0.30	1.15	2	14	21
	10	23	26	25.31	4	49	21.2	29.070 113	0.30	1.15	2	10	20
	11	23	26	20.44	4	49	54.3	29.061 284	0.30	1.15	2	06	19
	12	23	26	15.49	-4	50	27.8	29.052 703	0.30	1.15	2	02	18
	13	23	26	10.49	4	51	01.6	29.044 374	0.30	1.15	1	58	17
	14	23	26	05.42	4	51	35.9	29.036 299	0.30	1.15	1	54	16
	15	23	26	00.28	4	52	10.5	29.028 482	0.30	1.15	1	50	15
	16	23	25	55.08	-4	52	45.5	29.020 925	0.30	1.15	1	46	14

NEPTUNE, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Aug.	16	23	25	55.08	-4	52	45.5	29.020 925	0.30	1.15	1	46	14
	17	23	25	49.82	4	53	20.8	29.013 631	0.30	1.15	1	42	13
	18	23	25	44.50	4	53	56.5	29.006 603	0.30	1.15	1	38	12
	19	23	25	39.12	4	54	32.5	28.999 844	0.30	1.16	1	34	11
	20	23	25	33.69	4	55	08.9	28.993 356	0.30	1.16	1	30	09
	21	23	25	28.19	4	55	45.6	28.987 142	0.30	1.16	1	26	08
	22	23	25	22.64	-4	56	22.5	28.981 203	0.30	1.16	1	22	07
	23	23	25	17.05	4	56	59.8	28.975 542	0.30	1.16	1	18	05
	24	23	25	11.41	4	57	37.2	28.970 160	0.30	1.16	1	14	04
	25	23	25	05.73	4	58	14.9	28.965 058	0.30	1.16	1	10	02
	26	23	25	00.01	4	58	52.7	28.960 239	0.30	1.16	1	06	00
	27	23	24	54.26	4	59	30.8	28.955 704	0.30	1.16	1	01	59
	28	23	24	48.47	-5	00	09.0	28.951 453	0.30	1.16	0	57	57
	29	23	24	42.64	5	00	47.5	28.947 487	0.30	1.16	0	53	55
	30	23	24	36.78	5	01	26.1	28.943 809	0.30	1.16	0	49	54
	31	23	24	30.89	5	02	04.8	28.940 419	0.30	1.16	0	45	52
Sept.	1	23	24	24.96	5	02	43.8	28.937 317	0.30	1.16	0	41	50
	2	23	24	19.01	5	03	22.8	28.934 506	0.30	1.16	0	37	48
	3	23	24	13.03	-5	04	02.0	28.931 985	0.30	1.16	0	33	46
	4	23	24	07.03	5	04	41.3	28.929 757	0.30	1.16	0	29	45
	5	23	24	01.00	5	05	20.7	28.927 821	0.30	1.16	0	25	43
	6	23	23	54.96	5	06	00.1	28.926 179	0.30	1.16	0	21	41
	7	23	23	48.91	5	06	39.5	28.924 833	0.30	1.16	0	17	39
	8	23	23	42.84	5	07	19.0	28.923 781	0.30	1.16	0	13	37
	9	23	23	36.76	-5	07	58.5	28.923 026	0.30	1.16	0	09	35
	10	23	23	30.68	5	08	38.0	28.922 568	0.30	1.16	0	05	33
	11	23	23	24.59	5	09	17.4	28.922 408	0.30	1.16	0	01	31
	12	23	23	18.50	5	09	56.9	28.922 547	0.30	1.16	23	53	27
	13	23	23	12.41	5	10	36.2	28.922 984	0.30	1.16	23	49	25
	14	23	23	06.32	5	11	15.6	28.923 721	0.30	1.16	23	45	23
	15	23	23	00.23	-5	11	54.9	28.924 758	0.30	1.16	23	41	21
	16	23	22	54.14	5	12	34.2	28.926 094	0.30	1.16	23	37	19
	17	23	22	48.06	5	13	13.3	28.927 731	0.30	1.16	23	33	17
	18	23	22	41.98	5	13	52.4	28.929 667	0.30	1.16	23	29	15
	19	23	22	35.92	5	14	31.3	28.931 902	0.30	1.16	23	25	13
	20	23	22	29.87	5	15	10.1	28.934 437	0.30	1.16	23	21	12
	21	23	22	23.85	-5	15	48.6	28.937 269	0.30	1.16	23	17	10
	22	23	22	17.85	5	16	27.0	28.940 398	0.30	1.16	23	13	08
	23	23	22	11.88	5	17	05.1	28.943 823	0.30	1.16	23	09	06
	24	23	22	05.93	5	17	43.1	28.947 542	0.30	1.16	23	05	04
	25	23	22	00.01	5	18	20.8	28.951 554	0.30	1.16	23	01	02
	26	23	21	54.13	5	18	58.2	28.955 858	0.30	1.16	22	57	01
	27	23	21	48.27	-5	19	35.5	28.960 452	0.30	1.16	22	52	59
	28	23	21	42.44	5	20	12.5	28.965 334	0.30	1.16	22	48	57
	29	23	21	36.65	5	20	49.2	28.970 504	0.30	1.16	22	44	56
	30	23	21	30.89	5	21	25.6	28.975 960	0.30	1.16	22	40	54
Oct.	1	23	21	25.18	-5	22	01.8	28.981 699	0.30	1.16	22	36	53

NEPTUNE, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Oct.	1	23	21	25.18	-5	22	01.8	28.981 699	0.30	1.16	22	36	53
	2	23	21	19.50	5	22	37.6	28.987 722	0.30	1.16	22	32	51
	3	23	21	13.88	5	23	13.1	28.994 025	0.30	1.16	22	28	50
	4	23	21	08.30	5	23	48.2	29.000 608	0.30	1.16	22	24	48
	5	23	21	02.77	5	24	22.9	29.007 469	0.30	1.15	22	20	47
	6	23	20	57.30	5	24	57.3	29.014 605	0.30	1.15	22	16	46
	7	23	20	51.88	-5	25	31.2	29.022 016	0.30	1.15	22	12	44
	8	23	20	46.52	5	26	04.7	29.029 699	0.30	1.15	22	08	43
	9	23	20	41.23	5	26	37.8	29.037 653	0.30	1.15	22	04	42
	10	23	20	35.99	5	27	10.5	29.045 875	0.30	1.15	22	00	41
	11	23	20	30.81	5	27	42.8	29.054 364	0.30	1.15	21	56	40
	12	23	20	25.70	5	28	14.6	29.063 116	0.30	1.15	21	52	39
	13	23	20	20.65	-5	28	45.9	29.072 131	0.30	1.15	21	48	38
	14	23	20	15.67	5	29	16.8	29.081 405	0.30	1.15	21	44	37
	15	23	20	10.76	5	29	47.3	29.090 936	0.30	1.15	21	40	37
	16	23	20	05.92	5	30	17.2	29.100 721	0.30	1.15	21	36	36
	17	23	20	01.15	5	30	46.6	29.110 757	0.30	1.15	21	32	35
	18	23	19	56.47	5	31	15.4	29.121 041	0.30	1.15	21	28	35
	19	23	19	51.87	-5	31	43.6	29.131 570	0.30	1.15	21	24	35
	20	23	19	47.35	5	32	11.3	29.142 339	0.30	1.15	21	20	34
	21	23	19	42.93	5	32	38.4	29.153 345	0.30	1.15	21	16	34
	22	23	19	38.58	5	33	04.9	29.164 584	0.30	1.15	21	12	34
	23	23	19	34.33	5	33	30.8	29.176 053	0.30	1.15	21	08	34
	24	23	19	30.16	5	33	56.2	29.187 748	0.30	1.15	21	04	34
	25	23	19	26.08	-5	34	21.0	29.199 664	0.30	1.15	21	00	34
	26	23	19	22.09	5	34	45.1	29.211 799	0.30	1.15	20	56	34
	27	23	19	18.19	5	35	08.6	29.224 147	0.30	1.15	20	52	34
	28	23	19	14.38	5	35	31.5	29.236 706	0.30	1.15	20	48	35
	29	23	19	10.67	5	35	53.8	29.249 472	0.30	1.15	20	44	35
	30	23	19	07.06	5	36	15.4	29.262 441	0.30	1.14	20	40	36
	31	23	19	03.55	-5	36	36.3	29.275 608	0.30	1.14	20	36	37
Nov.	1	23	19	00.14	5	36	56.6	29.288 971	0.30	1.14	20	32	37
	2	23	18	56.84	5	37	16.1	29.302 525	0.30	1.14	20	28	38
	3	23	18	53.65	5	37	35.0	29.316 266	0.30	1.14	20	24	39
	4	23	18	50.56	5	37	53.1	29.330 190	0.30	1.14	20	20	40
	5	23	18	47.57	5	38	10.5	29.344 294	0.30	1.14	20	16	42
	6	23	18	44.70	-5	38	27.2	29.358 574	0.30	1.14	20	12	43
	7	23	18	41.94	5	38	43.2	29.373 025	0.30	1.14	20	08	44
	8	23	18	39.28	5	38	58.5	29.387 642	0.30	1.14	20	04	46
	9	23	18	36.74	5	39	13.1	29.402 423	0.30	1.14	20	00	47
	10	23	18	34.30	5	39	27.0	29.417 362	0.30	1.14	19	56	49
	11	23	18	31.98	5	39	40.1	29.432 456	0.30	1.14	19	52	51
	12	23	18	29.77	-5	39	52.5	29.447 699	0.30	1.14	19	48	53
	13	23	18	27.67	5	40	04.1	29.463 087	0.30	1.14	19	44	55
	14	23	18	25.70	5	40	14.9	29.478 615	0.30	1.14	19	40	57
	15	23	18	23.85	5	40	24.9	29.494 278	0.30	1.14	19	36	60
	16	23	18	22.12	-5	40	34.2	29.510 070	0.30	1.14	19	33	02

NEPTUNE, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Nov.	16	23	18	22.12	-5	40	34.2	29.510 070	0.30	1.14	19	33	02
	17	23	18	20.52	5	40	42.6	29.525 986	0.30	1.13	19	29	05
	18	23	18	19.04	5	40	50.2	29.542 021	0.30	1.13	19	25	08
	19	23	18	17.69	5	40	57.0	29.558 170	0.30	1.13	19	21	10
	20	23	18	16.45	5	41	03.1	29.574 426	0.30	1.13	19	17	13
	21	23	18	15.34	5	41	08.4	29.590 786	0.30	1.13	19	13	16
	22	23	18	14.34	-5	41	12.9	29.607 242	0.30	1.13	19	09	20
	23	23	18	13.47	5	41	16.6	29.623 791	0.30	1.13	19	05	23
	24	23	18	12.72	5	41	19.5	29.640 427	0.30	1.13	19	01	26
	25	23	18	12.10	5	41	21.6	29.657 144	0.30	1.13	18	57	30
	26	23	18	11.60	5	41	22.9	29.673 939	0.30	1.13	18	53	34
	27	23	18	11.23	5	41	23.4	29.690 805	0.30	1.13	18	49	38
	28	23	18	10.99	-5	41	23.1	29.707 738	0.30	1.13	18	45	41
	29	23	18	10.87	5	41	21.9	29.724 733	0.30	1.13	18	41	46
	30	23	18	10.89	5	41	19.9	29.741 784	0.30	1.13	18	37	50
Dec.	1	23	18	11.03	5	41	17.1	29.758 888	0.30	1.13	18	33	54
	2	23	18	11.31	5	41	13.5	29.776 037	0.30	1.13	18	29	59
	3	23	18	11.71	5	41	09.0	29.793 229	0.30	1.12	18	26	03
	4	23	18	12.24	-5	41	03.7	29.810 458	0.30	1.12	18	22	08
	5	23	18	12.90	5	40	57.7	29.827 718	0.29	1.12	18	18	13
	6	23	18	13.68	5	40	50.8	29.845 005	0.29	1.12	18	14	18
	7	23	18	14.59	5	40	43.1	29.862 314	0.29	1.12	18	10	23
	8	23	18	15.62	5	40	34.7	29.879 640	0.29	1.12	18	06	28
	9	23	18	16.78	5	40	25.4	29.896 977	0.29	1.12	18	02	33
	10	23	18	18.07	-5	40	15.3	29.914 320	0.29	1.12	17	58	39
	11	23	18	19.49	5	40	04.4	29.931 664	0.29	1.12	17	54	44
	12	23	18	21.04	5	39	52.7	29.949 002	0.29	1.12	17	50	50
	13	23	18	22.72	5	39	40.1	29.966 331	0.29	1.12	17	46	56
	14	23	18	24.53	5	39	26.7	29.983 643	0.29	1.12	17	43	02
	15	23	18	26.48	5	39	12.5	30.000 933	0.29	1.12	17	39	08
	16	23	18	28.55	-5	38	57.5	30.018 196	0.29	1.12	17	35	14
	17	23	18	30.75	5	38	41.7	30.035 425	0.29	1.12	17	31	21
	18	23	18	33.07	5	38	25.1	30.052 615	0.29	1.11	17	27	27
	19	23	18	35.51	5	38	07.7	30.069 761	0.29	1.11	17	23	34
	20	23	18	38.08	5	37	49.6	30.086 856	0.29	1.11	17	19	40
	21	23	18	40.77	5	37	30.7	30.103 897	0.29	1.11	17	15	47
	22	23	18	43.58	-5	37	11.0	30.120 878	0.29	1.11	17	11	54
	23	23	18	46.51	5	36	50.6	30.137 794	0.29	1.11	17	08	01
	24	23	18	49.57	5	36	29.4	30.154 639	0.29	1.11	17	04	09
	25	23	18	52.74	5	36	07.4	30.171 409	0.29	1.11	17	00	16
	26	23	18	56.05	5	35	44.6	30.188 099	0.29	1.11	16	56	23
	27	23	18	59.47	5	35	21.1	30.204 704	0.29	1.11	16	52	31
	28	23	19	03.01	-5	34	56.8	30.221 220	0.29	1.11	16	48	39
	29	23	19	06.68	5	34	31.8	30.237 642	0.29	1.11	16	44	46
	30	23	19	10.46	5	34	06.1	30.253 965	0.29	1.11	16	40	54
	31	23	19	14.36	5	33	39.6	30.270 185	0.29	1.11	16	37	02
	32	23	19	18.37	-5	33	12.4	30.286 298	0.29	1.11	16	33	11

PLUTO, 2020

HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Heliocentric Longitude ° ′ ″	Heliocentric Latitude ° ′ ″	Radius Vector	Date	Heliocentric Longitude ° ′ ″	Heliocentric Latitude ° ′ ″	Radius Vector
Jan. 1	292 45 09.5	-0 40 17.8	33.950 45	July 4	293 40 48.6	-0 57 15.9	34.072 19
6	292 46 40.0	0 40 45.4	33.953 74	9	293 42 18.5	0 57 43.3	34.075 49
11	292 48 10.5	0 41 13.0	33.957 02	14	293 43 48.4	0 58 10.7	34.078 78
16	292 49 41.0	0 41 40.7	33.960 31	19	293 45 18.3	0 58 38.1	34.082 08
21	292 51 11.5	0 42 08.3	33.963 59	24	293 46 48.2	0 59 05.5	34.085 38
26	292 52 42.0	0 42 35.8	33.966 88	29	293 48 18.0	0 59 32.8	34.088 68
31	292 54 12.5	-0 43 03.5	33.970 16	Aug. 3	293 49 47.9	-1 00 00.2	34.091 97
Feb. 5	292 55 42.9	0 43 31.0	33.973 45	8	293 51 17.7	1 00 27.6	34.095 27
10	292 57 13.4	0 43 58.6	33.976 73	13	293 52 47.5	1 00 55.0	34.098 57
15	292 58 43.8	0 44 26.2	33.980 02	18	293 54 17.3	1 01 22.3	34.101 87
20	293 00 14.2	0 44 53.7	33.983 31	23	293 55 47.1	1 01 49.7	34.105 17
25	293 01 44.5	0 45 21.3	33.986 59	28	293 57 16.9	1 02 17.0	34.108 46
Mar. 1	293 03 14.9	-0 45 48.9	33.989 88	Sept. 2	293 58 46.6	-1 02 44.4	34.111 76
6	293 04 45.2	0 46 16.4	33.993 17	7	294 00 16.3	1 03 11.7	34.115 06
11	293 06 15.6	0 46 44.0	33.996 46	12	294 01 46.0	1 03 39.0	34.118 36
16	293 07 45.9	0 47 11.5	33.999 75	17	294 03 15.7	1 04 06.3	34.121 66
21	293 09 16.2	0 47 39.0	34.003 04	22	294 04 45.4	1 04 33.6	34.124 96
26	293 10 46.4	0 48 06.6	34.006 33	27	294 06 15.0	1 05 01.0	34.128 26
31	293 12 16.7	-0 48 34.1	34.009 62	Oct. 2	294 07 44.7	-1 05 28.2	34.131 56
Apr. 5	293 13 47.0	0 49 01.6	34.012 91	7	294 09 14.3	1 05 55.5	34.134 86
10	293 15 17.2	0 49 29.1	34.016 20	12	294 10 43.9	1 06 22.8	34.138 17
15	293 16 47.4	0 49 56.6	34.019 49	17	294 12 13.5	1 06 50.1	34.141 47
20	293 18 17.6	0 50 24.1	34.022 78	22	294 13 43.1	1 07 17.4	34.144 77
25	293 19 47.8	0 50 51.6	34.026 07	27	294 15 12.6	1 07 44.7	34.148 07
30	293 21 17.9	-0 51 19.1	34.029 37	Nov. 1	294 16 42.2	-1 08 11.9	34.151 37
May 5	293 22 48.1	0 51 46.6	34.032 66	6	294 18 11.7	1 08 39.2	34.154 68
10	293 24 18.2	0 52 14.1	34.035 95	11	294 19 41.2	1 09 06.5	34.157 98
15	293 25 48.3	0 52 41.5	34.039 25	16	294 21 10.7	1 09 33.7	34.161 29
20	293 27 18.4	0 53 09.0	34.042 54	21	294 22 40.1	1 10 00.9	34.164 59
25	293 28 48.5	0 53 36.4	34.045 83	26	294 24 09.6	1 10 28.2	34.167 89
30	293 30 18.6	-0 54 03.9	34.049 13	Dec. 1	294 25 39.0	-1 10 55.4	34.171 20
June 4	293 31 48.6	0 54 31.3	34.052 42	6	294 27 08.5	1 11 22.6	34.174 50
9	293 33 18.6	0 54 58.8	34.055 72	11	294 28 37.9	1 11 49.9	34.177 81
14	293 34 48.6	0 55 26.2	34.059 01	16	294 30 07.2	1 12 17.1	34.181 11
19	293 36 18.7	0 55 53.6	34.062 31	21	294 31 36.6	1 12 44.3	34.184 42
24	293 37 48.6	0 56 21.1	34.065 60	26	294 33 06.0	1 13 11.5	34.187 73
29	293 39 18.6	-0 56 48.5	34.068 90	31	294 34 35.3	-1 13 38.7	34.191 03
July 4	293 40 48.6	-0 57 15.9	34.072 19	36	294 36 04.6	-1 14 05.8	34.194 34

N.B: Pluto is now classified as a dwarf planet as per resolution of IAU

PLUTO, 2020

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Jan.	1	292	23	08.4	-0	39	10.3	July	4	294	01	17.8	-0	58	58.3
	6	292	33	04.9	0	39	36.2		9	293	54	10.4	0	59	28.0
	11	292	43	07.6	0	40	02.5		14	293	46	56.6	0	59	56.9
	16	292	53	11.2	0	40	29.3		19	293	39	41.6	1	00	25.0
	21	293	03	13.7	0	40	56.5		24	293	32	29.2	1	00	52.3
	26	293	13	11.3	0	41	24.4		29	293	25	22.8	1	01	18.7
	31	293	22	59.2	-0	41	52.8	Aug.	3	293	18	27.9	-1	01	44.4
Feb.	5	293	32	34.7	0	42	21.6		8	293	11	46.5	1	02	09.2
	10	293	41	54.7	0	42	51.1		13	293	05	22.8	1	02	33.2
	15	293	50	54.8	0	43	21.1		18	292	59	21.2	1	02	56.4
	20	293	59	33.4	0	43	51.6		23	292	53	43.9	1	03	18.9
	25	294	07	46.3	0	44	22.7		28	292	48	35.5	1	03	40.6
Mar.	1	294	15	30.4	-0	44	54.2	Sept.	2	292	43	58.3	-1	04	01.6
	6	294	22	44.1	0	45	26.3		7	292	39	54.2	1	04	21.9
	11	294	29	23.8	0	45	58.8		12	292	36	26.7	1	04	41.7
	16	294	35	28.2	0	46	31.8		17	292	33	37.6	1	05	00.8
	21	294	40	55.3	0	47	05.3		22	292	31	28.5	1	05	19.5
	26	294	45	42.1	0	47	39.1		27	292	30	02.1	1	05	37.8
	31	294	49	48.1	-0	48	13.2	Oct.	2	292	29	17.9	-1	05	55.7
Apr.	5	294	53	12.2	0	48	47.7		7	292	29	17.3	1	06	13.3
	10	294	55	52.5	0	49	22.4		12	292	30	01.6	1	06	30.7
	15	294	57	50.1	0	49	57.4		17	292	31	29.7	1	06	48.0
	20	294	59	03.1	0	50	32.5		22	292	33	43.2	1	07	05.2
	25	294	59	31.5	0	51	07.7		27	292	36	40.4	1	07	22.4
	30	294	59	16.7	-0	51	43.0	Nov.	1	292	40	20.1	-1	07	39.6
May	5	294	58	18.2	0	52	18.2		6	292	44	42.3	1	07	57.0
	10	294	56	38.0	0	52	53.4		11	292	49	44.9	1	08	14.7
	15	294	54	17.2	0	53	28.5		16	292	55	26.4	1	08	32.6
	20	294	51	16.1	0	54	03.4		21	293	01	45.9	1	08	51.0
	25	294	47	37.8	0	54	38.0		26	293	08	39.2	1	09	09.7
	30	294	43	24.3	-0	55	12.3	Dec.	1	293	16	05.0	-1	09	29.0
June	4	294	38	37.5	0	55	46.2		6	293	24	00.9	1	09	48.8
	9	294	33	21.6	0	56	19.6		11	293	32	23.0	1	10	09.2
	14	294	27	37.8	0	56	52.6		16	293	41	09.9	1	10	30.3
	19	294	21	29.8	0	57	25.0		21	293	50	17.3	1	10	52.1
	24	294	15	01.8	0	57	56.7		26	293	59	41.5	1	11	14.7
	29	294	08	16.1	-0	58	27.9		31	294	09	20.1	-1	11	38.1
July	4	294	01	17.8	-0	58	58.3		36	294	19	08.9	-1	12	02.3

N.B : Pluto is now classified as a dwarf planet as per resolution of I.A.U

PLUTO, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Red. To Astrom. (J 2000.0)	Apparent Declination			Red. To Astrom. (J 2000.0)	True Distance from the Earth	Hor. Parallax	Ephemeris Transit	
		h	m	s	s	°	'	"	"		"	h	m
Jan.	1	19	37	09.77	+68.83	-22	13	16.9	-159.47	34.910 171	0.25	12	55
	6	19	37	52.45	68.82	22	12	04.5	160.58	34.928 382	0.25	12	36
	11	19	38	35.55	68.89	22	10	50.8	161.87	34.939 315	0.25	12	17
	16	19	39	18.72	68.90	22	9	37.1	162.77	34.942 941	0.25	11	58
	21	19	40	01.80	68.94	22	8	22.9	164.13	34.939 237	0.25	11	39
	26	19	40	44.53	69.02	22	7	09.7	165.32	34.928 221	0.25	11	20
	31	19	41	26.57	+69.06	-22	5	58.1	-166.34	34.910 001	0.25	11	01
Feb.	5	19	42	07.72	69.13	22	4	48.2	167.65	34.884 769	0.25	10	42
	10	19	42	47.76	69.24	22	3	41.1	168.76	34.852 777	0.25	10	23
	15	19	43	26.40	69.29	22	2	37.3	169.82	34.814 291	0.25	10	04
	20	19	44	03.51	69.41	22	1	37.2	171.10	34.769 579	0.25	9	45
	25	19	44	38.80	69.51	22	0	41.8	172.04	34.718 976	0.25	9	26
Mar.	1	19	45	12.05	+69.58	-21	59	51.3	-173.12	34.662 900	0.25	9	07
	6	19	45	43.14	69.72	21	59	06.3	174.31	34.601 824	0.25	8	48
	11	19	46	11.84	69.84	21	58	27.6	175.13	34.536 244	0.25	8	28
	16	19	46	38.03	69.96	21	57	55.1	176.27	34.466 641	0.26	8	09
	21	19	47	01.60	70.11	21	57	29.6	177.18	34.393 505	0.26	7	50
	26	19	47	22.31	70.22	21	57	11.5	177.94	34.317 397	0.26	7	31
	31	19	47	40.15	+70.37	-21	57	00.7	-178.93	34.238 925	0.26	7	11
Apr.	5	19	47	55.02	70.54	21	56	58.0	179.65	34.158 715	0.26	6	52
	10	19	48	06.80	70.67	21	57	03.1	180.33	34.077 375	0.26	6	32
	15	19	48	15.57	70.85	21	57	16.1	181.14	33.995 472	0.26	6	13
	20	19	48	21.18	71.01	21	57	37.6	181.57	33.913 601	0.26	5	53
	25	19	48	23.65	71.15	21	58	06.9	182.14	33.832 398	0.26	5	34
	30	19	48	23.06	+71.35	-21	58	44.2	-182.69	33.752 511	0.26	5	14
May	5	19	48	19.39	71.51	21	59	29.5	182.86	33.674 558	0.26	4	54
	10	19	48	12.75	71.68	22	0	22.1	183.33	33.599 099	0.26	4	34
	15	19	48	03.25	71.87	22	1	22.1	183.47	33.526 663	0.26	4	15
	20	19	47	50.90	72.02	22	2	29.1	183.47	33.457 801	0.26	3	55
	25	19	47	35.90	72.19	22	3	42.2	183.65	33.393 066	0.26	3	35
	30	19	47	18.41	+72.38	-22	5	01.6	-183.47	33.332 983	0.26	3	15
June	4	19	46	58.55	72.51	22	6	26.3	183.27	33.278 009	0.26	2	55
	9	19	46	36.61	72.70	22	7	55.6	183.16	33.228 522	0.26	2	35
	14	19	46	12.69	72.85	22	9	29.5	182.64	33.184 889	0.27	2	15
	19	19	45	47.04	72.97	22	11	06.5	182.28	33.147 475	0.27	1	55
	24	19	45	19.95	73.14	22	12	46.4	181.85	33.116 614	0.27	1	35
	29	19	44	51.59	+73.25	-22	14	28.6	-181.07	33.092 575	0.27	1	15
July	4	19	44	22.31	73.37	22	16	11.8	180.61	33.075 529	0.27	0	54
	9	19	43	52.37	73.50	22	17	55.9	179.81	33.065 591	0.27	0	34
	14	19	43	21.95	73.56	22	19	39.8	178.95	33.062 868	0.27	0	14
	19	19	42	51.43	73.65	22	21	22.7	178.30	33.067 443	0.27	23	50
	24	19	42	21.06	73.74	22	23	04.3	177.30	33.079 340	0.27	23	30
	29	19	41	51.11	+73.77	-22	24	43.5	-176.43	33.098 493	0.27	23	10
Aug.	3	19	41	21.94	73.85	22	26	19.6	175.64	33.124 745	0.27	22	49
	8	19	40	53.72	73.87	22	27	52.5	174.56	33.157 921	0.27	22	29
	13	19	40	26.74	73.86	22	29	21.1	173.75	33.197 831	0.26	22	09
	18	19	40	01.31	+73.90	-22	30	45.0	-172.92	33.244 247	0.26	21	49

N.B: Pluto is now classified as a dwarf planet as per resolution of I A U

PLUTO, 2020

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Red. To Astrom. (J 2000.0)	Apparent Declination			Red. To Astrom. (J 2000.0)	True Distance from the Earth	Hor. Parallax	Ephemeris Transit	
		h	m	s	s	°	'	"	"		"	h	m
Aug.	18	19	40	01.31	+73.90	-22	30	45.0	-172.92	33.244 247	0.26	21	49
	23	19	39	37.59	73.87	22	32	03.9	171.89	33.296 871	0.26	21	29
	28	19	39	15.90	73.86	22	33	16.8	171.27	33.355 308	0.26	21	09
Sept.	2	19	38	56.43	73.84	22	34	24.0	170.38	33.419 125	0.26	20	49
	7	19	38	39.30	73.76	22	35	24.7	169.61	33.487 891	0.26	20	29
	12	19	38	24.76	73.72	22	36	18.5	169.13	33.561 163	0.26	20	09
	17	19	38	12.95	+73.67	-22	37	05.6	-168.40	33.638 458	0.26	19	49
	22	19	38	03.98	73.58	22	37	45.3	167.98	33.719 218	0.26	19	30
	27	19	37	58.05	73.54	22	38	17.6	167.65	33.802 832	0.26	19	10
Oct.	2	19	37	55.11	73.44	22	38	42.7	167.18	33.888 700	0.26	18	50
	7	19	37	55.28	73.34	22	38	60.0	167.09	33.976 243	0.26	18	31
	12	19	37	58.64	73.28	22	39	09.8	167.02	34.064 874	0.26	18	11
	17	19	38	05.12	+73.16	-22	39	12.4	-166.85	34.153 975	0.26	17	51
	22	19	38	14.83	73.09	22	39	07.1	167.18	34.242 874	0.26	17	32
	27	19	38	27.66	73.01	22	38	54.8	167.23	34.330 906	0.26	17	12
Nov.	1	19	38	43.51	72.90	22	38	35.3	167.52	34.417 460	0.26	16	53
	6	19	39	02.39	72.83	22	38	08.7	168.08	34.501 954	0.25	16	34
	11	19	39	24.15	72.76	22	37	35.7	168.42	34.583 812	0.25	16	14
	16	19	39	48.68	+72.67	-22	36	56.0	-169.11	34.662 436	0.25	15	55
	21	19	40	15.91	72.64	22	36	10.3	169.85	34.737 222	0.25	15	36
	26	19	40	45.55	72.56	22	35	19.0	170.45	34.807 634	0.25	15	17
Dec.	1	19	41	17.50	72.50	22	34	22.1	171.43	34.873 203	0.25	14	58
	6	19	41	51.59	72.49	22	33	20.5	172.33	34.933 502	0.25	14	39
	11	19	42	27.54	72.43	22	32	14.6	173.16	34.988 115	0.25	14	20
	16	19	43	05.25	+72.43	-22	31	04.4	-174.40	35.036 625	0.25	14	00
	21	19	43	44.42	72.43	22	29	51.1	175.31	35.078 668	0.25	13	41
	26	19	44	24.78	72.39	22	28	34.9	176.42	35.113 975	0.25	13	22
	31	19	45	06.16	72.42	22	27	16.3	177.72	35.142 348	0.25	13	04
	36	19	45	48.26	+72.43	-22	25	56.4	-178.71	35.163 627	0.25	12	45

N.B: Pluto is now classified as a dwarf planet as per resolution of I A U

MAJOR PLANETS, 2020
HELIOCENTRIC OSCULATING ORBITAL ELEMENTS
REFERRED TO THE MEAN ECLIPTIC AND EQUINOX OF J 2000.0

Date	Julian Date 245	Inclination i	Longitude Asc. Node Ω	Longitude Perihelion ϖ	Mean Distance a	Daily Motion n	Eccentricity e	Mean Longitude L
				MERCURY				
		°	°	°		°		°
Nov'19 23	8800.5	7.0038	48.307	77.489	0.387 098	4.092 36	0.205 651	64.2144
Jan'20 2	8840.5	7.0038	48.307	77.489	0.387 098	4.092 36	0.205 651	227.9086
Feb 11	8880.5	7.0038	48.306	77.490	0.387 097	4.092 37	0.205 651	31.6028
Mar 23	8920.5	7.0038	48.306	77.489	0.387 097	4.092 37	0.205 652	195.2971
May 2	8960.5	7.0038	48.306	77.489	0.387 098	4.092 36	0.205 648	358.9913
Jun 11	9000.5	7.0038	48.306	77.489	0.387 097	4.092 37	0.205 647	162.6855
Jul 21	9040.5	7.0037	48.306	77.490	0.387 100	4.092 31	0.205 635	326.3785
Aug 30	9080.5	7.0037	48.305	77.491	0.387 010	4.092 34	0.205 634	130.0715
Oct 9	9120.5	7.0037	48.305	77.492	0.387 099	4.092 33	0.205 633	293.7648
Nov 18	9160.5	7.0070	48.305	77.492	0.387 099	4.092 34	0.205 633	97.4582
Dec 28	9200.5	7.0037	48.305	77.491	0.387 098	4.092 35	0.205 637	261.1516
Feb' 21 6	9240.5	7.0037	48.305	77.492	0.387 098	4.092 36	0.205 636	64.8455
				VENUS				
Nov'19 23	8800.5	3.3946	76.625	131.51	0.723 331	1.602 14	0.006 733	286.2376
Jan' 20 2	8840.5	3.3946	76.625	131.53	0.723 324	1.602 16	0.006 744	350.3233
Feb 11	8880.5	3.3946	76.625	131.50	0.723 326	1.602 15	0.006 746	54.4099
Mar 23	8920.5	3.3946	76.625	131.46	0.723 328	1.602 15	0.006 746	118.4955
May 2	8960.5	3.3946	76.624	131.46	0.723 327	1.602 15	0.006 745	182.5813
Jun 11	9000.5	3.3946	76.624	131.63	0.723 342	1.602 10	0.006 752	246.6655
Jul 21	9040.5	3.3946	76.623	131.73	0.723 336	1.602 12	0.006 772	310.7476
Aug 30	9080.5	3.3946	76.623	131.80	0.723 323	1.602 16	0.006 787	14.8333
Oct 9	9120.5	3.3946	76.623	131.77	0.723 325	1.602 15	0.006 791	78.9199
Nov 18	9160.5	3.3946	76.623	131.72	0.723 329	1.602 14	0.006 793	143.0053
Dec 28	9200.5	3.3946	76.623	131.70	0.723 325	1.602 15	0.006 790	207.0913
Feb' 21 6	9240.5	3.3945	76.623	131.75	0.723 330	1.602 14	0.006 786	271.1773
				EARTH*				
Nov'19 23	8800.5	0.0026	176.8	103.073	0.999 996	0.985 62	0.016 749	51.5530
Jan' 20 2	8840.5	0.0026	176.8	103.029	1.000 007	0.985 60	0.016 754	90.9764
Feb 11	8880.5	0.0026	176.6	103.001	1.000 008	0.985 60	0.016 755	130.3994
Mar 23	8920.5	0.0026	176.6	102.981	1.000 000	0.985 61	0.016 750	169.8236
May 2	8960.5	0.0026	176.7	102.961	0.999 994	0.985 62	0.016 742	209.2491
Jun 11	9000.5	0.0027	177.4	102.943	0.999 999	0.985 61	0.016 728	248.6754
Jul 21	9040.5	0.0027	176.7	102.943	1.000 021	0.985 58	0.016 703	288.1000
Aug 30	9080.5	0.0027	176.4	102.980	1.000 014	0.985 59	0.016 706	327.5224
Oct 9	9120.5	0.0027	176.3	103.033	0.999 997	0.985 61	0.016 714	6.9465
Nov 18	9160.5	0.0027	176.4	103.052	0.999 992	0.985 62	0.016 717	46.3717
Dec 28	9200.5	0.0027	176.5	103.036	0.999 997	0.985 62	0.016 719	85.7961
Feb' 21 6	9240.5	0.0027	176.4	103.001	1.000 001	0.985 61	0.016 724	125.2195

* Values labelled for the Earth are actually for the Earth/ Moon barycente

FORMULAS

Mean anomaly, $M = L - \varpi$

Argument of perihelion, measured from node $\omega = \varpi - \Omega$

True anomaly, $\nu = M + (2e - e^3/4)\sin M + (5e^2/4)\sin 2M + (13\, e^3/12)\sin 3M + \ldots$ in radians

True distance, $r = a\,(1 - e^2)/(1 + e\cos\nu)$

Heliocentric rectangular co- ordinates, referred to the ecliptic of date, may be computed from

$x = r\{\cos(\nu + \omega)\cos\Omega - \sin(\nu + \omega)\cos i\,\sin\Omega\}$

$y = r\{\cos(\nu + \omega)\sin\Omega + \sin(\nu + \omega)\cos i\,\cos\Omega\}$

$z = r\sin(\nu + \omega)\sin i$

MAJOR PLANETS, 2020
HELIOCENTRIC OSCULATING ORBITAL ELEMENTS
REFERRED TO THE MEAN ECLIPTIC AND EQUINOX OF J 2000.0

Date	Julian Date 245	Inclination i	Longitude Asc. Node Ω	Longitude Perihelion ϖ	Mean Distance a	Daily Motion n	Eccentricity e	Mean Longitude L
MARS		°	°	°		°		°
Nov'19 23	8800.5	1.8481	49.501	336.189	1.523 60	0.524 080	0.093 505	197.5675
Jan' 20 2	8840.5	1.8481	49.501	336.184	1.523 61	0.524 075	0.093 505	218.5313
Feb 11	8880.5	1.8480	49.501	336.169	1.523 65	0.524 055	0.093 495	239.4939
Mar 23	8920.5	1.8480	49.501	336.142	1.523 72	0.524 020	0.093 482	260.4543
May 2	8960.5	1.8480	49.500	336.114	1.523 78	0.523 989	0.093 476	281.4122
Jun 11	9000.5	1.8479	49.499	336.098	1.523 79	0.523 982	0.093 463	302.3687
Jul 21	9040.5	1.8479	49.497	336.098	1.523 75	0.524 004	0.093 435	323.3270
Aug 30	9080.5	1.8479	49.496	336.104	1.523 68	0.524 040	0.093 393	344.2887
Oct 9	9120.5	1.8479	49.494	336.108	1.523 63	0.524 069	0.093 355	5.2530
Nov 18	9160.5	1.8480	49.494	336.116	1.523 61	0.524 076	0.093 334	26.2186
Dec 28	9200.5	1.8479	49.494	336.126	1.523 63	0.524 066	0.093 330	47.1825
Feb' 21 6	9240.5	1.8479	49.494	336.140	1.523 67	0.524 048	0.093 332	68.1446
JUPITER								
Nov'19 23	8800.5	1.3037	100.516	14.024	5.203 39	0.083 078	0.048 733	277.2581
Jan' 20 2	8840.5	1.3036	100.516	14.020	5.203 41	0.083 077	0.048 723	280.5801
Feb 11	8880.5	1.3036	100.516	14.019	5.203 41	0.083 077	0.048 708	283.9014
Mar 23	8920.5	1.3036	100.516	14.999	5.203 50	0.083 075	0.048 686	287.2220
May 2	8960.5	1.3036	100.516	14.961	5.203 66	0.083 071	0.048 671	290.5431
Jun 11	9000.5	1.3036	100.516	14.925	5.203 81	0.083 067	0.048 664	293.8648
Jul 21	9040.5	1.3036	100.516	14.906	5.203 90	0.083 065	0.048 665	297.1873
Aug 30	9080.5	1.3036	100.516	14.916	5.203 85	0.083 067	0.048 658	300.5094
Oct 9	9120.5	1.3036	100.516	14.929	5.203 76	0.083 069	0.048 642	303.8306
Nov 18	9160.5	1.3036	100.516	14.937	5.203 68	0.083 070	0.048 618	307.1511
Dec 28	9200.5	1.3036	100.516	14.926	5.203 69	0.083 070	0.048 599	310.4715
Feb' 21 6	9240.5	1.3036	100.516	14.915	5.203 70	0.083 070	0.048 587	313.7926
SATURN								
Nov'19 23	8800.5	2.4862	113.595	92.041	9.572 3	0.033 301	0.051 794	292.7290
Jan' 20 2	8840.5	2.4862	113.595	91.920	9.572 2	0.033 301	0.051 846	294.0755
Feb 11	8880.5	2.4862	113.595	91.806	9.572 0	0.033 302	0.051 906	295.4216
Mar 23	8920.5	2.4863	113.595	91.692	9.572 1	0.033 302	0.051 951	296.7670
May 2	8960.5	2.4862	113.595	91.556	9.572 3	0.033 300	0.051 980	298.1138
Jun 11	9000.5	2.4862	113.595	91.407	9.572 6	0.033 299	0.052 014	299.4621
Jul 21	9040.5	2.4862	113.595	91.250	9.572 8	0.033 298	0.052 072	300.8122
Aug 30	9080.5	2.4862	113.595	91.112	9.572 7	0.033 299	0.052 160	302.1623
Oct 9	9120.5	2.4862	113.595	90.988	9.572 5	0.033 299	0.052 252	303.5113
Nov 18	9160.5	2.4863	113.595	90.872	9.572 4	0.033 300	0.052 337	304.8592
Dec 28	9200.5	2.4863	113.595	90.744	9.572 5	0.033 299	0.052 400	306.2068
Feb' 21 6	9240.5	2.4863	113.595	90.608	9.572 7	0.033 298	0.052 467	307.5554
URANUS								
Nov'19 23	8800.5	0.7706	74.083	174.12	19.147 3	0.011 771	0.047 739	38.1445
Feb' 20 11	8880.5	0.7705	74.085	173.89	19.154 5	0.011 765	0.047 388	39.0751
May 2	8960.5	0.7704	74.090	173.70	19.160 7	0.011 759	0.047 066	40.0033
Jul 21	9040.5	0.7704	74.093	173.39	19.169 3	0.011 751	0.046 651	40.9305
Oct 9	9120.5	0.7704	74.093	172.98	19.178 6	0.011 742	0.046 283	41.8666
Dec 28	9200.5	0.7703	74.097	172.62	19.186 2	0.011 735	0.045 987	42.8032
Mar' 21 18	9280.5	0.7703	74.096	172.21	19.194 9	0.011 728	0.045 661	43.7392
NEPTUNE								
Nov'19 23	8800.5	1.7704	131.780	23.51	30.142 0	0.005 960	0.008 522	348.0054
Feb' 20 11	8880.5	1.7702	131.775	22.28	30.157 0	0.005 955	0.008 990	348.4950
May 2	8960.5	1.7700	131.771	21.06	30.171 5	0.005 951	0.009 434	348.9804
Jul 21	9040.5	1.7698	131.765	19.92	30.189 7	0.005 946	0.010 014	349.4722
Oct 9	9120.5	1.7696	131.760	19.69	30.203 7	0.005 942	0.010 523	349.9730
Dec 28	9200.5	1.7695	131.758	19.59	30.215 1	0.005 938	0.010 940	350.4698
Mar' 21 18	9280.5	1.7693	131.752	19.52	30.227 8	0.005 935	0.011 410	350.9696

Distances are in astronomical units

CENTRE OF MASS OF THE SOLAR SYSTEM, 2020

HELIOCENTRIC RECTANGULAR CO-ORDINATES
EQUATORIAL RECTANGULAR CO-ORDINATES OF THE BARYCENTRES $_4$
(SUN TO MARS) AND S_9 (SUN TO PLUTO) REFERRED TO THE MEAN
EQUINOX AND EQUATOR OF J 2000.0

Date		Barycentre S_4 (In units of 10^{-10} a.u)			Centre of Mass of the Solar System Barycentre S_9 (In units of 10^{-9} a.u)		
		x	y	z	X	Y	Z
Jan.	0	+37911256	-68162195	-29801540	+3790271	-6818756	-2981143
	10	38740022	67963653	29740454	3873691	6799200	2975172
	20	39565157	67756980	29675653	3956852	6778730	2968796
	30	40386851	67542798	29607423	4039757	6757378	2962030
Feb.	9	41205424	67321819	29536101	4122413	6735180	2954890
	19	42021875	67094800	29462168	4204863	6712174	2947401
	29	+42837811	-66861652	-29385691	+4287179	-6688356	-2939565
Mar.	10	43654276	66621546	29306355	4369406	6663686	2931368
	20	44471756	66373652	29223772	4451561	6638123	2922790
	30	45290529	66117157	29137584	4533649	6611627	2913813
Apr.	9	46110699	65851191	29047404	4615668	6584156	2904418
	19	46932095	65574846	28952834	4697602	6555665	2894586
	29	+47754206	-65287341	-28853495	+4779417	-6526117	-2884298
May	9	48576339	64988218	28749186	4861071	6495490	2873544
	19	49398236	64677261	28639887	4942543	6463775	2862324
	29	50219807	64353594	28525236	5023821	6430929	2850620
June	8	51040109	64016248	28404719	5104850	6396906	2838407
	18	51857779	63664718	28278012	5185554	6361682	2825669
	28	+52671381	-63298900	-28144992	+5265853	-6325254	-2812401
July	8	53479532	62919010	28005672	5345671	6287635	2798604
	18	54280879	62525521	27860209	5424932	6248850	2784287
	28	55074148	62119270	27708902	5503565	6208944	2769465
Aug.	7	55858391	61701569	27552350	5581514	6167984	2754169
	17	56633701	61273791	27391253	5658777	6126042	2738435
	27	+57400433	-60836501	-27225910	+5735363	-6083148	-2722279
Sept.	6	58158547	60390158	27056475	5811263	6039328	2705709
	16	58907983	59935407	26883234	5886466	5994617	2688741
	26	59648897	59472931	26706477	5960973	5949052	2671390
Oct.	6	60381588	59003330	26526504	6034790	5902666	2653673
	16	61106466	58527064	26343515	6107931	5855485	2635600
	26	+61823896	-58044604	-26157757	+6180406	-5807536	-2617185
Nov.	5	62534572	57556547	25969583	6252243	5758852	2598447
	15	63239844	57063020	25779183	6323501	5709443	2579397
	25	63940803	56563219	25586234	6394228	5659272	2560020
Dec.	5	64637713	56056245	25390279	6464429	5608298	2540294
	15	65330490	55541395	25190970	6534093	5556490	2520204
	25	+66018879	-55018068	-24987976	+6603200	-5503821	-2499734
	35	+66702414	-54485773	-24781021	+6671719	-5450271	-2478872

The heliocentric equatorial rectangular co-ordinates of the barycentre of the solar system referred to the mean equator and equinox of J 2020.5 are given by $\mathbf{r} = P\mathbf{r_0}$, where $\mathbf{r}$ and $\mathbf{r_0}$ are the column vectors of the co-ordinates X,Y, Z and X_0,Y_0, Z_0 referred to J 2020.5 and J 2000.0 respectively.

PART - II

STARS

LONGITUDE AND LATITUDE OF STARS, 2020.5

MEAN PLACES FOR JULY 2^d.125 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude °	′	″	Annual Variation ″	Annual Proper Motion ″	Latitude °	′	″	Annual Variation ″	Annual Proper Motion ″
35	280	α Sculptoris	4.31	0	46	51.47	50.620	+0.025	-32	30	46.83	+0.040	-0.007
9	74	ι Ceti	3.56	1	12	10.08	50.350	-0.028	-10	01	17.64	+0.030	-0.028
82	674	φ Eridani	3.56	1	17	28.82	51.190	+0.110	-58	59	09.12	-0.030	-0.082
902	9072	ω Piscium	4.01	2	52	12.75	50.340	+0.095	+6	21	44.39	-0.110	-0.167
22	188	β Ceti	2.04	2	52	20.22	50.710	+0.242	-20	47	00.88	+0.000	-0.068
783	7957	η Cephei	3.43	4	58	08.98	51.240	+2.354	+71	46	56.41	+0.450	+0.369
156	1336	α Reticuli	3.35	7	48	23.17	52.760	+0.298	-78	02	23.93	+0.080	-0.015
869	8762	ο Andromedae	3.62	8	03	48.45	49.880	+0.022	+43	45	02.63	+0.080	-0.017
848	8585	α Lacertae	3.77	8	25	38.04	49.880	+0.200	+53	17	26.79	+0.040	-0.070
7	39	γ Pegasi	2.83	9	26	30.64	50.190	+0.001	+12	36	01.78	+0.110	-0.011
40	334	η Ceti	3.45	12	03	19.80	50.580	+0.151	-16	07	07.78	-0.080	-0.213
803	8162	α Cephei	2.44	13	03	35.31	49.470	+0.340	+68	54	50.25	+0.050	-0.100
836	8465	ζ Cephei	3.35	14	14	41.15	49.510	+0.028	+61	08	52.74	+0.140	-0.008
1	15	α Andromedae*	2.06	14	35	38.35	50.140	+0.056	+25	40	48.58	-0.050	-0.207
47	402	θ Ceti	3.6	16	30	44.16	50.260	-0.163	-15	46	02.73	+0.000	-0.171
723	7310	δ Draconis	3.07	17	25	56.80	47.550	+0.757	+82	53	12.42	+0.090	-0.093
59	509	τ Ceti	3.5	18	05	54.20	49.130	-1.371	-24	48	23.31	+1.650	+1.463
890	8961	λ Andromedae	3.82v	18	34	12.95	49.750	-0.133	+43	46	27.96	-0.260	-0.441
1075	794	ι Eridani	4.11	19	03	43.48	51.010	+0.169	-51	42	49.88	+0.090	-0.095
71	585	ν Ceti	4	19	42	59.56	50.690	+0.134	-31	02	00.30	+0.120	-0.076
1033	361	ζ Piscium*	5.24	20	09	52.47	50.410	+0.112	-0	12	46.53	+0.090	-0.106
20	165	δ Andromedae	3.27	22	05	57.72	50.200	+0.092	+24	21	03.99	+0.070	-0.141
62	539	ζ Ceti	3.73	22	14	15.13	50.470	+0.025	-20	20	01.15	+0.160	-0.051
106	897	θ Eridani p	3.25	23	33	42.15	50.810	-0.051	-53	44	19.46	+0.270	+0.038
101	841	β Fornacis	4.46	26	31	28.56	50.920	+0.212	-45	51	14.68	+0.350	+0.103
1154	2015	δ Doradus	4.35	26	48	11.39	63.160	-0.278	-88	15	08.04	+0.280	+0.030
50	437	η Piscium	3.62	27	06	08.14	50.280	+0.024	+5	22	44.24	+0.240	-0.015
33	269	μ Andromedae	3.87	29	27	41.03	50.250	+0.174	+29	39	36.13	+0.230	-0.038
42	337	β Andromedae	2.06	30	41	28.66	50.240	+0.126	+25	56	37.99	+0.090	-0.178
863	8694	ι Cephei	3.52	33	31	16.60	49.280	-0.304	+62	37	03.36	+0.270	-0.017
66	553	β Arietis*	2.64	34	15	22.82	50.300	+0.051	+8	29	17.33	+0.160	-0.138
1085	919	τ^3 Eridani	4.09	34	49	17.70	50.390	-0.198	-38	54	15.53	+0.300	+0.001
17	153	ζ Cassiopeiae	3.66	35	20	58.94	49.960	+0.016	+44	43	17.10	+0.280	-0.018
2	21	β Cassiopeiae	2.27	35	24	11.34	50.310	+0.463	+51	12	50.39	-0.170	-0.472
809	8238	β Cephei	3.23	35	49	36.86	49.280	+0.028	+71	09	16.11	+0.300	-0.008
64	544	α Trianguli	3.41	37	08	46.44	50.110	-0.079	+16	48	03.74	+0.090	-0.223
91	779	δ Ceti	4.07	37	51	29.91	50.390	+0.013	-14	27	35.82	+0.310	-0.008
74	617	α Arietis	2	37	56	57.31	50.370	+0.130	+9	57	56.75	+0.110	-0.204
21	168	α Cassiopeiae	2.23	38	04	05.66	49.960	+0.036	+46	37	25.25	+0.260	-0.056
171	1465	α Doradus	3.27	38	07	25.41	51.700	+0.155	-74	34	48.59	+0.290	-0.031
104	874	η Eridani	3.89	39	02	14.20	50.460	+0.008	-24	32	46.36	+0.100	-0.233

* **No. 1 : *Alpheratz*, Uttara Bhadrapada - 2** **No. 66 : *Sheratan*, Asvini**

No. 1033 : Revati

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2020.5

MEAN PLACES FOR JULY $2^d.125$ TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
75	622	β Trianguli	3	42	38	20.54	50.310	+0.134	+20	34	55.71	+0.260	-0.091
79	664	γ Trianguli	4.01	43	48	14.62	50.220	+0.028	+18	56	59.72	+0.290	-0.064
32	264	γ Cassiopeiae	var.	44	12	56.32	49.980	+0.027	+48	49	00.51	+0.340	-0.019
73	603	γ Andromed. p	2.26	44	30	39.77	50.160	+0.024	+27	48	28.38	+0.300	-0.065
107	911	α Ceti	2.53	44	36	24.23	50.330	-0.032	-12	35	02.32	+0.280	-0.072
155	1326	α Horologii	3.86	46	06	47.13	50.770	-0.073	-61	43	47.95	+0.160	-0.211
48	403	δ Cassiopeiae	2.68	48	12	59.50	50.320	+0.323	+46	24	16.01	+0.170	-0.202
127	1084	ε Eridani	3.73	48	26	56.44	49.390	-1.054	-27	42	43.20	+0.660	+0.281
100	838	41 Arietis*	3.63	48	29	23.21	50.280	+0.029	+10	27	03.96	+0.250	-0.132
135	1136	δ Eridani	3.54	51	08	59.77	50.560	+0.113	-28	40	11.71	+1.130	+0.744
121	1030	ο Tauri	3.6	51	26	59.19	50.250	-0.084	-9	19	56.49	+0.340	-0.059
123	1038	ξ Tauri	3.74	52	11	56.10	50.390	+0.049	-8	47	48.01	+0.340	-0.053
212	1922	β Doradus	3.48v	52	25	32.71	53.300	+0.072	-85	02	30.97	+0.400	+0.007
149	1231	γ Eridani	2.95	54	09	18.02	50.490	+0.039	-33	12	01.95	+0.280	-0.123
63	542	ε Cassiopeiae	3.38	55	02	55.23	50.060	+0.024	+47	33	01.24	+0.380	-0.034
109	921	ρ Persei	var.	55	11	50.19	50.310	+0.099	+20	34	34.19	+0.270	-0.139
1129	1502	α Caeli	4.45	56	26	05.78	50.390	-0.346	-62	59	09.69	+0.380	-0.032
111	936	β Persei	var.	56	27	12.48	50.200	+0.003	+22	25	51.26	+0.410	-0.002
103	854	τ Persei	3.95	58	11	50.48	50.140	-0.003	+34	22	25.13	+0.410	-0.005
99	834	η Persei	3.76	58	59	14.58	50.150	+0.013	+37	29	03.03	+0.410	-0.019
136	1142	17 Tauri	3.7	59	41	53.70	50.290	+0.009	+4	11	31.17	+0.380	-0.049
170	1464	ν^2 Eridani	3.82	60	10	21.63	50.470	-0.076	-51	48	53.23	+0.430	-0.002
151	1251	ν Tauri	3.91	60	12	21.07	50.350	+0.005	-14	26	57.41	+0.420	-0.004
139	1165	η Tauri*	2.87	60	16	43.44	50.290	+0.008	+4	03	11.10	+0.380	-0.049
108	915	γ Persei	2.93	60	18	25.47	50.160	-0.002	+34	31	57.52	+0.430	-0.004
893	8974	γ Cephei	3.21	60	22	43.60	50.150	+0.268	+64	40	22.86	+0.550	+0.119
150	1239	λ Tauri	3.47v	60	55	15.66	50.310	-0.009	-7	57	26.71	+0.420	-0.011
120	1017	α Persei	1.79	62	22	00.55	50.200	+0.018	+30	07	40.10	+0.400	-0.030
144	1203	ζ Persei	2.85	63	24	36.21	50.260	+0.004	+11	20	09.30	+0.430	-0.011
134	1135	ν Persei	3.77	64	06	32.64	50.210	-0.015	+22	09	21.95	+0.440	+0.002
131	1122	δ Persei	3.01	65	05	17.15	50.240	+0.021	+27	18	14.67	+0.410	-0.040
148	1228	ξ Persei	4.04	65	15	30.96	50.260	+0.002	+14	56	46.80	+0.440	-0.000
147	1220	ε Persei	2.89	65	57	50.17	50.260	+0.013	+19	07	00.92	+0.410	-0.029
159	1346	γ Tauri	3.65	66	05	34.32	50.420	+0.110	-5	43	47.99	+0.410	-0.044
162	1373	δ Tauri	3.76	67	09	27.83	50.410	+0.101	-3	58	02.05	+0.400	-0.047
164	1409	ε Tauri	3.54	68	45	07.28	50.400	+0.100	-2	33	53.68	+0.400	-0.054
168	1457	α Tauri*	0.85	70	04	33.01	50.340	+0.036	-5	27	57.16	+0.260	-0.197
1134	1543	π^3 Orionis	3.19	72	12	50.48	50.810	+0.481	-15	22	54.62	+0.420	-0.046
186	1654	ε Leporis	3.19	72	20	33.70	50.420	+0.021	-44	57	44.79	+0.380	-0.076
179	1552	π^4 Orionis	3.69	72	23	14.53	50.320	-0.001	-16	46	09.45	+0.460	+0.001
180	1567	π^5 Orionis	3.72	72	46	38.51	50.330	+0.000	-20	00	08.90	+0.460	-0.000

* **No. 100 : Bharani** **No. 168 : *Aldebaran*, Rohini**

No. 139 : *Alcyone* , Krittika.

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2020.5

MEAN PLACES FOR JULY 2^{d}.125 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude °	'	"	Annual Variation "	Annual Proper Motion "	Latitude °	'	"	Annual Variation "	Annual Proper Motion "
188	1666	β Eridani	2.79	75	33	42.50	50.220	-0.116	-27	51	34.30	+0.390	-0.071
1144	1702	μ Leporis	3.31v	75	40	52.57	50.410	+0.051	-39	02	51.36	+0.440	-0.030
695	6927	χ Draconis	3.57	76	10	55.35	44.150	+3.497	+83	34	17.28	+0.620	-0.501
181	1577	ι Aurigae	2.69	76	55	32.80	50.280	+0.001	+10	27	25.36	+0.450	-0.018
194	1713	β Orionis	0.12	77	06	58.27	50.330	+0.000	-31	07	12.48	+0.470	-0.001
195	1735	τ Orionis	3.6	78	08	01.21	50.310	-0.018	-29	50	06.16	+0.460	-0.007
1137	1612	ζ Aurigae	3.75	78	55	11.00	50.280	+0.007	+18	12	17.39	+0.440	-0.023
183	1605	ε Aurigae	var.	79	07	39.68	50.280	-0.001	+20	56	49.25	+0.460	-0.004
185	1641	η Aurigae	3.17	79	43	57.40	50.310	+0.024	+18	17	09.98	+0.400	-0.070
204	1829	β Leporis	2.84	79	57	32.12	50.320	-0.015	-43	54	44.60	+0.380	-0.088
201	1790	γ Orionis	1.64	81	13	58.17	50.300	-0.010	-16	48	48.55	+0.460	-0.013
178	1542	α Camelopardi	4.29	81	15	56.99	50.270	+0.001	+43	25	17.82	+0.470	+0.006
182	1603	β Camelopardi	4.03	81	33	14.44	50.260	-0.010	+37	26	01.03	+0.460	-0.015
207	1865	α Leporis	2.58	81	40	01.37	50.320	+0.001	-41	03	18.43	+0.480	+0.002
193	1708	α Aurigae	0.08	82	08	40.17	50.330	+0.046	+22	51	52.36	+0.050	-0.429
215	1956	α Columbae	2.64	82	27	21.26	50.330	+0.009	-57	22	21.75	+0.440	-0.027
206	1852	δ Orionis	2.23	82	40	58.49	50.310	+0.002	-22	57	10.65	+0.460	-0.002
202	1791	β Tauri	1.65	82	51	40.96	50.310	+0.012	+5	23	12.29	+0.290	-0.176
209	1899	ι Orionis	2.77	83	17	02.15	50.300	+0.000	-29	11	50.34	+0.470	+0.001
210	1903	ε Orionis	1.7	83	45	00.18	50.300	+0.001	-24	30	13.46	+0.470	-0.002
(GC)	1879	λ Orionis*	3.56	83	59	35.61	50.290	-0.001	-13	22	00.40	+0.470	-0.002
211	1910	ζ Tauri	3	85	04	15.62	50.300	-0.000	-2	11	35.09	+0.450	-0.021
217	1983	γ Leporis	3.6	85	07	47.67	49.850	-0.440	-45	49	03.33	+0.120	-0.359
219	1998	ζ Leporis	3.55	86	16	21.25	50.270	-0.020	-38	12	47.36	+0.470	-0.000
220	2004	κ Orionis	2.06	86	41	05.91	50.290	+0.002	-33	04	04.84	+0.470	-0.002
223	2040	β Columbae	3.12	86	42	23.55	50.410	+0.136	-59	10	28.66	+0.870	+0.399
222	2035	δ Leporis	3.81	87	27	18.69	50.580	+0.301	-44	17	53.27	-0.190	-0.653
907	424	α Ursae Mins.	2.02	88	51	16.36	50.400	+0.037	+66	06	14.10	+0.430	-0.036
224	2061	α Orionis*	var.	89	02	27.95	50.310	+0.027	-16	01	27.48	+0.480	+0.009
226	2085	η Leporis	3.71	89	11	09.42	50.210	-0.051	-37	36	00.44	+0.610	+0.140
229	2120	η Columbae	3.96	89	53	51.41	50.260	+0.055	-66	15	05.89	+0.460	-0.014
227	2088	β Aurigae	1.9	90	11	47.38	50.250	-0.062	+21	30	39.11	+0.470	+0.000
225	2077	δ Aurigae	3.72	90	12	24.13	50.410	+0.095	+30	50	50.69	+0.340	-0.125
1168	2219	κ Aurigae	4.35	93	39	02.57	50.240	-0.066	+6	06	17.27	+0.200	-0.264
241	2286	μ Geminorum	2.88	95	35	18.92	50.360	+0.059	-0	49	05.28	+0.350	-0.109
244	2298	8ε Monocerotis	4.44	96	32	27.58	50.250	-0.019	-18	42	53.39	+0.470	+0.010
1173	2343	ν Geminorum	4.15	97	05	19.48	50.280	-0.007	-3	03	13.78	+0.440	-0.014
243	2294	β Canis Maj.	1.98	97	28	25.33	50.200	-0.008	-41	15	03.99	+0.460	-0.000
240	2282	ζ Canis Maj.	3.02	97	39	47.84	50.170	+0.015	-53	22	12.27	+0.470	+0.003
251	2421	γ Geminorum	1.93	99	23	28.50	50.330	+0.045	-6	44	24.50	+0.410	-0.039
254	2473	ε Geminorum	2.98	100	13	30.62	50.290	-0.005	+2	04	20.81	+0.440	-0.014

* **No. GC : *Mrgasiras* .** **No. 224 : *Betelgeuse* , Mag. 0.4 to 1.3 Ardra.**

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2020.5

MEAN PLACES FOR JULY 2^{d}.125 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude °	'	"	Annual Variation "	Annual Proper Motion "	Latitude °	'	"	Annual Variation "	Annual Proper Motion "
261	2540	θ Geminorum	3.6	101	24	35.85	50.330	+0.003	+11	01	56.81	+0.400	-0.048
256	2484	ξ Geminorum	3.36	101	29	41.55	50.170	-0.101	-10	06	10.10	+0.250	-0.200
257	2491	α Canis Maj cg	-1.5	104	21	50.11	49.610	-0.552	-39	36	35.52	-0.810	-1.256
245	2326	α Carinae	-0.7	105	14	37.71	49.730	+0.075	-75	49	16.50	+0.460	+0.024
269	2650	ζ Geminorum	3.79v	105	16	35.43	50.280	-0.009	-2	02	10.84	+0.440	-0.002
252	2451	ν Puppis	3.17	107	25	55.53	49.900	+0.008	-66	04	18.37	+0.430	-0.006
279	2777	δ Geminorum	3.53	108	48	19.84	50.270	-0.024	-0	10	33.76	+0.420	-0.016
1180	2538	κ Canis Maj.	3.96	108	51	03.51	50.010	-0.013	-55	08	42.28	+0.430	+0.003
277	2763	λ Geminorum	3.58	109	03	53.48	50.230	-0.042	-5	37	58.86	+0.390	-0.043
282	2821	ι Geminorum	3.79	109	14	35.33	50.200	-0.109	+5	45	36.53	+0.330	-0.103
1187	2714	22 δ Monocerotis	4.15	109	40	49.84	50.210	-0.002	-21	44	33.13	+0.430	+0.005
287	2891	α Gemino. *Cg**	1.95	110	31	34.76	50.170	-0.156	+10	05	51.85	+0.300	-0.126
268	2618	ε Canis Maj.	1.5	111	02	52.17	50.040	+0.006	-51	21	27.98	+0.430	+0.003
270	2653	o^{2} Canis Maj.	3.02	111	17	16.31	50.070	-0.007	-46	07	40.71	+0.420	+0.002
1183	2646	σ Canis Maj.	3.47	111	50	27.52	50.030	-0.009	-50	13	24.36	+0.430	+0.004
285	2845	β Canis Min.	2.9	112	28	39.10	50.200	-0.047	-13	29	06.37	+0.370	-0.046
317	3323	*o* Ursae Maj.	3.36	113	16	57.31	50.360	-0.121	+40	14	41.85	+0.270	-0.145
295	2990	β Geminorum	1.14	113	29	55.24	49.710	-0.614	+6	41	08.32	+0.260	-0.158
273	2693	δ Canis Maj.	1.86	113	40	51.28	50.030	-0.006	-48	27	02.99	+0.420	+0.004
294	2985	κ Geminorum	3.57	113	57	07.45	50.280	-0.024	+3	04	49.97	+0.350	-0.057
291	2943	α C. Min. *cg*	0.38	116	04	06.27	49.680	-0.541	-16	01	25.42	-0.730	-1.132
263	2553	τ Puppis	2.93	118	00	33.60	49.650	+0.188	-72	51	04.88	+0.330	-0.056
293	2970	26 α Monoceroti	3.93	119	33	57.65	50.060	-0.078	-30	27	05.52	+0.360	-0.033
283	2827	η Canis Maj.	2.45	119	49	15.43	49.960	-0.008	-50	36	23.53	+0.390	+0.004
278	2773	π Puppis	2.7	120	35	03.97	49.830	-0.019	-58	31	21.99	+0.390	+0.002
335	3569	ι Ursae Maj.	3.14	123	05	05.58	50.060	-0.399	+29	34	30.79	+0.010	-0.358
341	3594	κ Ursae Maj.	3.6	124	13	26.25	50.440	-0.015	+28	58	52.49	+0.300	-0.062
312	3249	β Cancri	3.52	124	32	35.70	50.200	-0.032	-10	17	09.08	+0.310	-0.058
321	3366	η Cancri	5.33	125	41	38.20	50.270	-0.035	+1	34	23.08	+0.300	-0.054
1204	3045	ξ Puppis	3.34	126	19	34.64	49.980	-0.003	-44	56	14.90	+0.350	-0.003
368	3888	*ν* Ursae Maj.	3.8	126	33	15.46	50.320	-0.261	+42	39	10.19	+0.080	-0.269
328	3475	ι Cancri	4.02	126	37	57.89	50.340	-0.013	+10	25	41.69	+0.310	-0.047
358	3775	θ Ursae Maj.	3.17	127	32	49.34	49.700	-0.820	+34	53	35.10	-0.510	-0.862
1228	3449	γ Cancri	4.66	127	49	27.85	50.220	-0.092	+3	11	31.46	+0.280	-0.066
1194	2878	ρ Puppis	3.25	128	58	18.67	49.380	-0.262	-63	46	18.18	+0.500	+0.157
326	3461	δ Cancri*	3.94	129	00	31.04	50.340	+0.043	+0	04	40.09	+0.120	-0.225
1223	3410	δ Hydrae	4.16	130	35	23.94	50.160	-0.064	-12	23	26.97	+0.310	-0.024
433	4434	λ Draconis	3.84	130	37	22.75	50.800	-0.026	+57	14	34.27	+0.290	-0.040
1224	3418	σ Hydrae	4.44	131	29	44.23	50.190	-0.013	-14	36	00.51	+0.310	-0.022
308	3185	ρ Puppis	2.81	131	40	21.68	49.840	-0.128	-43	16	05.17	+0.350	+0.023
352	3705	α Lyncis	3.13	132	07	41.60	50.180	-0.227	+17	57	55.94	+0.270	-0.054

* **No. 287 : *Castor*, Punarvasu-2, Mag. 1.95 & 2.95.** **No. 326 : Pusya.**

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2020.5

MEAN PLACES FOR JULY $2^d.125$ TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
1239	3627	ξ Cancri	5.14	133	29	50.33	50.330	-0.000	+5	25	32.57	+0.310	+0.005
550	5563	β Ursae Min.	2.08	133	36	44.13	51.410	-0.044	+72	59	21.20	+0.280	-0.031
337	3572	α Cancri	4.25	133	55	41.13	50.300	+0.041	-5	04	43.55	+0.290	-0.020
334	3547	ζ Hydrae	3.11	134	51	40.00	50.120	-0.101	-10	58	04.63	+0.290	-0.014
417	4301	α Ursae Maj.	1.79	135	29	09.03	50.640	-0.087	+49	40	52.28	+0.170	-0.125
(329)	3482	ε Hydrae m*	3.38	136	22	21.93	49.900	-0.228	-23	26	07.48	+0.190	-0.105
472	4787	κ Draconis	3.87v	136	32	46.72	50.900	-0.090	+61	45	49.17	+0.250	-0.042
306	3165	ζ Puppis	2.25	138	50	00.27	49.630	-0.057	-58	20	46.42	+0.280	+0.000
416	4295	β Ursae Maj.	2.37	139	43	25.30	50.760	+0.071	+45	08	05.83	+0.340	+0.073
383	4033	λ Ursae Maj.	3.45	139	50	11.82	50.360	-0.155	+29	53	10.66	+0.170	-0.103
347	3665	θ Hydrae	3.88	140	34	32.31	50.420	+0.224	-13	03	07.63	+0.010	-0.255
367	3873	ε Leonis	2.98	140	59	29.08	50.320	-0.040	+9	43	00.17	+0.240	-0.026
386	4069	μ Ursae Maj.	3.05	141	31	19.14	50.410	-0.101	+28	59	58.39	+0.260	-0.003
371	3905	μ Leonis	3.88	141	42	57.07	50.190	-0.188	+12	20	58.54	+0.140	-0.127
569	5735	γ Ursae Min.	3.05	141	53	33.38	51.710	-0.080	+75	14	32.95	+0.240	-0.019
262	2550	α Pictoris	3.27	144	22	18.27	45.040	-1.937	-83	02	15.45	+0.390	+0.148
365	3852	ο Leonis	3.52	144	31	57.44	50.150	-0.122	-3	45	22.68	+0.160	-0.081
327	3468	α Pyxidis	3.68	146	47	02.60	49.790	-0.022	-48	55	17.71	+0.230	+0.006
354	3748	α Hydrae	1.98	147	33	52.24	50.100	-0.026	-22	22	51.75	+0.240	+0.026
309	3207	γ^2 Velorum	1.78	147	37	51.79	49.410	-0.015	-64	27	46.57	+0.220	+0.004
384	4031	ζ Leonis	3.44	147	51	08.87	50.400	+0.020	+11	51	58.61	+0.220	+0.000
1250	3845	ι Hydrae	3.91	147	55	40.90	50.250	+0.070	-14	16	34.66	+0.170	-0.044
379	3975	η Leonis	3.52	148	11	30.13	50.330	-0.001	+4	52	00.87	+0.210	-0.001
420	4335	ψ Ursae Maj.	3.01	149	06	03.05	50.550	-0.054	+35	32	18.96	+0.150	-0.055
380	3982	α Leonis*	1.35	150	06	51.23	50.070	-0.235	+0	27	55.81	+0.120	-0.082
447	4554	γ Ursae Maj.	2.44	150	45	59.63	50.860	+0.104	+47	08	34.76	+0.260	+0.065
303	3117	χ Carinae	3.47	151	00	28.80	48.980	-0.105	-70	19	32.00	+0.200	+0.001
456	4660	δ Ursae Maj.	3.31	151	21	17.98	50.960	+0.119	+51	39	29.55	+0.260	+0.074
364	3849	κ Hydrae	5.06	152	57	42.68	50.050	-0.020	-26	35	55.20	+0.150	-0.028
1243	3718	θ Pyxidis	4.72	153	20	36.85	49.930	-0.008	-39	02	00.64	+0.160	-0.012
441	4518	χ Ursae Maj.	3.71	153	56	51.80	50.510	-0.177	+41	32	40.56	+0.120	-0.048
396	4133	ρ Leonis	3.85	156	40	31.07	50.290	-0.005	+0	09	01.94	+0.140	-0.005
425	4377	ν Ursae Maj.	3.48	156	56	27.84	50.480	-0.040	+26	09	48.11	+0.160	+0.014
521	5291	α Draconis	3.65	157	44	52.10	51.220	-0.111	+66	21	45.64	+0.100	-0.037
1261	3970	ν^2 Hydrae	4.6	158	36	35.80	50.060	-0.045	-23	10	37.56	+0.130	+0.003
483	4905	ε Ursae Maj.	1.77	159	13	27.41	51.070	+0.150	+54	19	11.81	+0.200	+0.070
381	3994	λ Hydrae	3.61	159	39	05.04	49.950	-0.165	-22	00	50.98	-0.030	-0.159
1270	4116	δ Sextantis	5.21	160	23	32.24	50.170	-0.040	-11	20	42.83	+0.090	-0.031
345	3634	λ Velorum	2.21	161	28	12.16	49.580	-0.040	-55	52	12.63	+0.120	+0.001
422	4357	δ Leonis*	2.56	161	36	16.93	50.600	+0.188	+14	20	01.79	+0.050	-0.062
423	4359	θ Leonis	3.34	163	42	34.98	50.350	-0.025	+9	40	27.34	-0.010	-0.096

* **No. 329 : Aslesa.** **No. 422 : *Zosma* , Purva Phalguni-1.**
No. 380 : *Regulus* , Magha.

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2020.5

MEAN PLACES FOR JULY $2^{d}.125$ TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
1227	3447	ο Velorum	3.62	165	00	50.97	49.170	-0.073	-66	16	33.36	+0.080	+0.001
389	4094	μ Hydrae	3.81	165	19	16.13	49.990	-0.093	-24	40	18.32	-0.040	-0.125
497	5054	ζ Ursae Maj. pr	2.27	165	59	29.55	51.180	+0.188	+56	22	47.09	+0.150	+0.067
1304	4527	93 Leonis*	4.53v	169	15	38.64	50.300	-0.140	+17	18	33.26	-0.020	-0.065
410	4232	ν Hydrae	3.11	170	39	05.07	50.120	+0.004	-21	47	47.74	+0.260	+0.221
444	4534	β Leonis	2.14	171	54	07.72	49.980	-0.417	+12	15	54.97	-0.280	-0.306
392	4104	α Antliae	4.25	172	43	28.73	49.850	-0.089	-37	25	39.25	-0.010	-0.025
315	3307	ε Carinae	1.86	173	24	24.05	48.690	-0.093	-72	40	47.83	+0.000	-0.011
1283	4287	α Crateris	4.08	173	58	18.52	49.580	-0.512	-22	43	00.15	-0.070	-0.074
485	4915	α CVn sq	2.9	174	51	13.12	50.390	-0.302	+40	07	14.39	-0.070	-0.069
426	4382	δ Crateris	3.56	176	58	16.87	49.940	-0.206	-17	34	18.46	+0.120	+0.139
509	5191	η Ursae Maj.	1.86	177	13	20.51	50.800	-0.155	+54	23	14.80	-0.110	-0.083
445	4540	β Virginis	3.61	177	27	18.37	51.090	+0.789	+0	41	39.78	+0.030	+0.047
353	3734	κ Velorum	2.5	179	10	22.64	49.320	-0.027	-63	43	18.89	-0.030	+0.000
531	5404	θ Bootis	4.05	182	54	07.97	51.260	+0.148	+60	06	21.15	-0.520	-0.456
639	6396	ζ Draconis	3.17	183	41	39.13	55.090	-0.288	+84	45	39.83	-0.090	-0.014
361	3803	N Velorum	3.13	184	29	39.68	49.280	-0.056	-64	14	20.47	-0.100	-0.020
460	4689	η Virginis	3.89	184	35	21.18	50.260	-0.051	+2	35	19.99	-0.120	-0.042
492	4983	β Com	4.26	184	38	45.87	49.270	-1.319	+32	30	50.70	+0.350	+0.429
571	5744	ι Draconis	3.29	185	14	36.43	51.590	-0.059	+71	05	35.07	-0.080	+0.004
351	3699	ι Carinae	2.25	185	36	22.53	49.150	-0.048	-67	07	00.97	-0.100	-0.011
1326	4828	ρ Virginis	4.88	185	48	03.60	50.520	+0.116	+13	32	31.84	-0.140	-0.049
375	3940	φVelorum	3.54	186	13	42.23	49.470	-0.019	-59	57	03.72	-0.090	-0.005
434	4450	ξ Hydrae	3.54	188	16	18.45	49.820	-0.193	-31	35	59.67	-0.240	-0.131
488	4932	ε Virginis	2.83	190	13	33.20	50.160	-0.269	+16	12	13.48	-0.210	-0.091
457	4662	γ Corvi	2.59	191	00	37.52	50.020	-0.161	-14	30	06.86	-0.170	-0.045
484	4910	δ Virginis	3.38	191	44	43.21	49.940	-0.415	+8	36	40.73	-0.370	-0.232
453	4630	ε Corvi	3	191	57	01.55	50.060	-0.074	-19	40	27.90	-0.150	-0.018
475	4813	χ Virginis	4.66	192	26	24.03	50.210	-0.060	-3	28	09.32	-0.190	-0.052
465	4757	δ Corvi*	2.95	193	44	12.41	50.060	-0.140	-12	11	54.09	-0.360	-0.211
319	3347	β Volantis	3.77	195	27	06.79	49.120	+0.547	-75	35	11.82	-0.250	-0.082
471	4786	β Corvi	2.65	197	39	13.19	50.180	+0.026	-18	02	45.29	-0.230	-0.048
535	5435	γ Bootis	3.03	197	57	04.31	50.530	-0.268	+49	33	03.56	-0.100	+0.079
513	5235	η Bootis	2.68	199	37	29.37	50.620	+0.095	+28	04	26.27	-0.550	-0.354
281	2803	δ Volantis	3.98	199	41	30.79	47.010	-0.039	-82	28	41.93	-0.200	-0.006
501	5107	ζ Virginis	3.37	201	58	25.73	50.090	-0.284	+9	44	33.40	-0.280	-0.066
534	5429	ρ Bootis	3.58	203	04	24.31	50.490	-0.191	+42	27	03.17	-0.160	+0.066
498	5056	α Virginis*	0.98	204	07	39.12	50.250	-0.028	-2	03	21.62	-0.270	-0.041
526	5340	α Bootis*	-0	204	31	11.34	50.260	-0.285	+30	43	19.32	-2.500	-2.265
555	5602	β Bootis	3.5	204	32	23.92	50.830	-0.039	+54	08	57.97	-0.270	-0.044
495	5020	γ Hydrae	3	207	18	16.52	50.280	+0.079	-13	44	39.11	-0.270	-0.017

* **No. 1304 : Uttara Phalguni-2.** **No. 498 : *Spica* , Citra.**

No. 465 : *Algorel* , Hasta. **No. 526 : *Arcturus* , Svati.**

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2020.5

MEAN PLACES FOR JULY $2^{d}.125$ TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
452	4621	δ Centauri	2.6	207	45	59.05	49.880	-0.033	-44	30	40.57	-0.280	-0.026
406	4199	θ Carinae	2.76	209	28	16.65	49.520	-0.046	-62	08	26.39	-0.280	-0.012
348	3685	β Carinae	1.68	212	14	45.22	48.660	-0.463	-72	14	18.28	-0.420	-0.133
496	5028	ι Centauri	2.75	213	24	44.95	49.810	-0.305	-26	01	08.94	-0.510	-0.219
563	5681	δ Bootis	3.47	213	26	50.67	50.910	+0.189	+48	57	48.60	-0.360	-0.069
525	5338	ι Virginis	4.08	214	05	05.40	50.490	+0.140	+7	11	43.89	-0.700	-0.409
523	5315	κ Virginis	4.19	214	46	48.12	50.280	-0.039	+2	54	43.28	-0.170	+0.135
436	4467	λ Centauri	3.13	214	49	37.33	49.700	-0.045	-56	47	28.27	-0.340	-0.033
455	4656	δ Crucis	2.8	215	56	54.19	49.820	-0.042	-50	25	17.30	-0.340	-0.033
468	4763	γ Crucis	1.63v	217	01	30.69	50.170	+0.257	-47	50	02.94	-0.510	-0.199
1371	5359	λ Virginis	4.52	217	14	18.41	50.280	-0.024	+0	29	20.37	-0.290	+0.023
385	4037	ω Carinae	3.32	217	43	15.48	49.410	-0.054	-67	23	03.86	-0.350	-0.033
519	5287	π Hydrae	3.27	218	54	37.38	50.310	+0.092	-13	03	07.39	-0.440	-0.115
572	5747	β Cr. Borealis	3.68	219	24	12.78	50.360	-0.286	+46	03	08.33	-0.310	+0.018
1189	2736	γ^2 Volantis	3.78	220	07	34.59	46.900	-0.682	-82	37	08.06	-0.350	+0.065
545	5487	μ Virginis	3.88	220	25	08.68	50.560	+0.203	+9	40	07.06	-0.610	-0.268
442	4520	λ Muscae	3.64	221	16	26.75	49.580	-0.181	-58	30	33.09	-0.390	-0.054
508	5193	μ Centauri	3.04v	221	49	17.43	50.100	-0.015	-28	58	52.91	-0.370	-0.028
481	4853	β Crucis	1.25	221	55	47.89	49.880	-0.046	-48	38	27.50	-0.380	-0.039
462	4730	α Crucis A	1.33	222	09	12.98	49.840	-0.031	-52	52	51.64	-0.370	-0.032
578	5793	α Cr.Borealis	2.23	222	35	06.47	50.800	+0.201	+44	19	16.78	-0.390	-0.044
520	5288	θ Centauri	2.06	222	35	32.68	49.850	-0.317	-22	05	08.73	-1.020	-0.672
608	6092	τ Herculis	3.89	224	40	27.64	50.910	-0.065	+65	49	41.00	-0.330	+0.032
512	5231	ζ Centauri	2.55	225	14	08.37	50.060	-0.040	-32	56	44.74	-0.430	-0.062
548	5531	α^2 Librae*	2.75	225	22	06.97	50.220	-0.082	+0	19	49.66	-0.450	-0.095
504	5132	ε Centauri	2.3	225	50	22.64	50.020	-0.023	-39	35	17.66	-0.390	-0.028
297	3024	ζ Volantis	3.95	226	02	12.29	48.560	-0.031	-79	23	22.05	-0.350	+0.034
391	4102	I Carinae	4	228	22	01.02	49.650	+0.052	-67	53	07.35	-0.410	-0.027
564	5685	β Librae	2.61	229	39	28.22	50.250	-0.089	+8	29	36.59	-0.430	-0.044
583	5867	β Serpentis	3.67	230	14	11.27	50.570	+0.093	+34	19	27.58	-0.410	-0.026
537	5440	η Centauri	2.31	230	32	04.01	50.140	-0.023	-25	30	55.81	-0.430	-0.044
474	4798	α Muscae	2.69	230	39	28.26	49.850	-0.045	-56	33	34.11	-0.430	-0.043
556	5603	σ Librae	3.29	230	58	23.20	50.200	-0.059	-7	38	49.38	-0.450	-0.062
559	5652	ι Librae	4.54	231	17	27.28	50.260	-0.024	-1	51	07.39	-0.440	-0.047
582	5854	α Serpentis	2.65	232	21	46.99	50.550	+0.134	+25	30	22.41	-0.320	+0.079
591	5933	γ Serpentis	3.85	233	04	22.94	51.240	+0.759	+35	11	12.61	-1.560	-1.164
541	5469	α Lupi	2.3	233	47	21.51	50.140	-0.016	-30	01	41.82	-0.430	-0.024
518	5267	β Centauri	0.61	234	04	37.66	50.030	-0.026	-44	08	24.39	-0.440	-0.032
469	4773	γ Muscae	3.87	234	18	06.80	49.830	-0.069	-58	52	23.53	-0.450	-0.045
588	5892	ε Serpentis	3.71	234	37	07.32	50.520	+0.121	+24	00	17.74	-0.320	+0.091
553	5576	κ Centauri	3.13	235	04	49.75	50.180	-0.011	-24	02	02.15	-0.440	-0.029

* **No. 548 : *Zuben el Genubi*, Visakha.**

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2020.5

MEAN PLACES FOR JULY 2^{d}.125 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
552	5571	β Lupi	2.68	235	18	40.30	50.160	-0.023	-25	02	55.57	-0.450	-0.048
577	5787	γ Librae	3.91	235	25	29.56	50.370	+0.061	+4	23	01.36	-0.380	+0.024
585	5881	μ Serpentis	3.54	236	13	31.56	50.280	-0.082	+16	14	08.18	-0.460	-0.042
487	4923	δ Muscae	3.62	236	28	35.19	50.310	+0.360	-56	46	37.22	-0.250	+0.163
566	5705	φ' Lupi	3.56	237	46	47.31	50.160	-0.067	-17	10	52.59	-0.530	-0.105
1413	5838	κ Librae	4.74	238	02	37.22	50.280	-0.013	-0	01	20.40	-0.530	-0.109
579	5794	ν Librae	3.58	238	53	44.13	50.250	-0.010	-8	30	35.49	-0.430	+0.000
1402	5695	δ Lupi	3.22	238	56	33.95	50.210	-0.008	-21	25	42.71	-0.450	-0.029
626	6220	η Herculis	3.53	239	04	36.61	50.770	+0.116	+60	17	13.38	-0.490	-0.070
609	6095	γ Herculis	3.75	239	30	05.10	50.390	-0.072	+40	00	19.86	-0.390	+0.032
538	5460	α Centauri cg	var.	239	44	09.73	45.220	-4.888	-42	36	12.71	-1.290	-0.861
401	4174	γ Chamaeleontis	4.11	240	42	16.75	49.760	-0.049	-68	05	12.71	-0.470	-0.040
558	5649	ζ Lupi	3.41	241	02	33.85	50.080	-0.099	-32	50	04.49	-0.540	-0.104
618	6148	β Herculis	2.77	241	22	40.66	50.340	-0.126	+42	41	59.05	-0.460	-0.034
613	6117	ω Herculis	4.57	241	51	46.44	50.490	+0.067	+35	09	56.22	-0.480	-0.050
603	6056	δ Ophiuchi	2.74	242	35	19.52	50.330	-0.018	+17	14	16.36	-0.590	-0.149
539	5463	α Circini	3.19	242	38	50.51	50.000	-0.104	-46	12	24.18	-0.730	-0.292
594	5953	δ Scorpii*	2.32	242	51	27.30	50.290	-0.001	-1	59	19.53	-0.470	-0.038
592	5944	π Scorpii	2.89	243	13	34.19	50.280	-0.006	-5	28	40.82	-0.470	-0.027
597	5984	β Scorpii pr	2.62	243	28	35.11	50.300	-0.002	+1	00	18.69	-0.460	-0.020
605	6075	ε Ophiuchi	3.24	243	47	49.88	50.430	+0.079	+16	26	15.04	-0.380	+0.055
459	4674	β Chamaeleontis	4.26	245	43	18.98	49.900	-0.083	-63	35	49.15	-0.480	-0.034
411	4234	δ^2 Chamaeleontis	4.45	245	56	24.71	49.890	-0.030	-67	47	36.61	-0.500	-0.048
607	6084	σ Scorpii	2.89	248	05	09.26	50.280	-0.007	-4	02	24.33	-0.470	-0.022
634	6324	ε Herculis	3.92	248	36	50.27	50.390	-0.085	+53	14	45.19	-0.430	+0.019
622	6175	ζ Ophiuchi	2.56	249	30	56.88	50.330	+0.010	+11	23	20.01	-0.430	+0.028
560	5671	γ Tr. Austrini	2.89	249	40	42.69	50.070	-0.082	-48	06	20.90	-0.510	-0.056
616	6134	α Scorpii cg*	var.	250	02	54.65	50.280	-0.006	-4	34	21.57	-0.470	-0.022
620	6165	τ Scorpii	2.82	251	44	35.64	50.280	-0.005	-6	07	23.39	-0.480	-0.023
633	6299	κ Ophiuchi	3.2	252	06	22.79	50.020	-0.339	+31	49	59.84	-0.510	-0.047
589	5897	β Tr.Australis	2.85	252	07	35.26	50.100	-0.100	-41	57	03.59	-0.890	-0.435
653	6536	β Draconis	2.79	252	15	16.46	50.620	-0.072	+75	16	31.00	-0.450	+0.011
643	6418	π Herculis	3.16	252	21	16.50	50.420	-0.051	+59	32	53.47	-0.460	-0.000
542	5470	α Apodis	3.83	254	42	55.37	50.160	-0.002	-58	14	15.55	-0.480	-0.019
641	6410	δ Herculis	3.14	255	03	01.47	50.390	-0.004	+47	40	55.48	-0.620	-0.158
628	6241	ε Scorpii	2.29	255	37	05.20	49.690	-0.588	-11	44	35.01	-0.800	-0.327
1439	6247	μ^1 Scorpii	3.08v	256	26	30.73	50.270	-0.008	-15	25	33.53	-0.490	-0.026
1435	6229	η Arae	3.76	259	11	26.65	50.320	+0.051	-36	16	45.21	-0.490	-0.023
631	6285	ζ Arae	3.13	260	06	36.24	50.250	-0.018	-33	05	40.33	-0.510	-0.038
663	6588	ι Herculis	3.8	260	10	34.09	50.380	-0.015	+69	15	46.39	-0.460	+0.005
638	6380	η Scorpii	3.33	261	01	46.28	50.340	+0.052	-20	11	16.07	-0.750	-0.284

* **No. 594 : *Dschubba*, Anuradha** **No. 616 : *Antares*, Jyestha, Mag. 0.9 to 1.8.**

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2020.5

MEAN PLACES FOR JULY 2^d.125 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
625	6217	α Tr. Austr.	1.92	261	10	55.85	50.290	+0.028	-46	09	15.25	-0.500	-0.031
644	6453	θ Ophiuchi	3.27	261	40	52.49	50.290	-0.002	-1	50	46.61	-0.490	-0.020
656	6556	α Ophiuchi	2.08	262	44	09.80	50.480	+0.163	+35	49	52.60	-0.690	-0.220
611	6102	γ Apodis	3.89	262	59	19.15	50.080	-0.191	-56	00	37.37	-0.580	-0.106
649	6508	ν Scorpii	2.69	264	17	56.71	50.290	+0.000	-14	00	40.33	-0.510	-0.031
645	6461	β Arae	2.85	264	29	31.90	50.280	-0.008	-32	16	04.03	-0.500	-0.026
658	6561	ξ Serpentis	3.54	264	49	56.02	50.260	-0.040	+7	55	54.09	-0.530	-0.060
652	6527	λ Scorpii*	1.63	264	52	19.74	50.300	-0.000	-13	47	28.66	-0.500	-0.029
671	6688	ξ Draconis	3.75	265	02	40.92	50.820	+0.525	+80	16	49.04	-0.380	+0.085
651	6510	α Arae	2.95	265	13	13.90	50.270	-0.030	-26	33	49.36	-0.540	-0.072
667	6623	μ Herculis	3.42	265	30	30.29	49.840	-0.452	+51	05	48.52	-1.230	-0.762
665	6603	β Ophiuchi	2.77	265	37	22.25	50.240	-0.051	+27	56	16.58	-0.310	+0.158
648	6500	δ Arae	3.62	265	50	33.61	50.240	-0.067	-37	21	33.00	-0.570	-0.099
654	6553	θ Scorpii	1.87	265	53	09.51	50.310	+0.016	-19	38	52.14	-0.470	-0.001
660	6580	κ Scorpii	2.41	266	45	21.01	50.290	-0.005	-15	38	49.97	-0.500	-0.027
668	6629	γ Ophiuchi	3.75	266	55	07.59	50.270	-0.023	+26	06	29.09	-0.540	-0.074
666	6615	ι^1 Scorpii	3.03	267	48	32.22	50.310	+0.000	-16	43	01.83	-0.480	-0.008
669	6630	*G* Scorpii	3.21	268	12	16.64	50.350	+0.049	-13	37	29.34	-0.440	+0.034
676	6705	γ Draconis	2.23	268	15	15.76	50.170	-0.028	+74	55	10.05	-0.490	-0.020
661	6582	η Pavonis	3.62	268	15	35.34	50.300	-0.017	-41	18	45.43	-0.520	-0.055
672	6695	θ Herculis	3.86	268	45	47.24	50.250	+0.009	+60	40	55.99	-0.470	+0.006
674	6703	ξ Herculis	3.7	269	28	57.49	50.380	+0.139	+52	40	58.30	-0.490	-0.017
673	6698	ν Ophiuchi	3.34	270	02	22.21	50.280	-0.007	+13	39	43.58	-0.580	-0.116
1471	6743	θ Arae	3.66	271	28	35.30	50.310	-0.012	-26	39	42.68	-0.480	-0.014
679	6746	γ Sagittarii	2.99	271	32	51.21	50.240	-0.056	-6	59	41.54	-0.660	-0.185
680	6771	72 Ophiuchi	3.73	272	26	45.99	50.190	-0.070	+32	59	13.77	-0.390	+0.081
681	6779	*o* Herculis	3.83	272	58	56.85	50.210	+0.002	+52	10	53.53	-0.450	+0.009
682	6812	μ Sagittarii	3.86	273	29	59.63	50.290	+0.002	+2	20	21.96	-0.460	+0.001
683	6832	η Sagittarii	3.11	273	54	48.54	50.180	-0.137	-13	22	53.33	-0.630	-0.162
687	6859	δ Sagittarii*	2.7	274	52	03.21	50.340	+0.034	-6	28	30.35	-0.500	-0.029
691	6897	α Telescopii	3.51	275	21	36.18	50.310	-0.021	-22	39	02.89	-0.520	-0.053
689	6879	ε Sagittarii	1.85	275	21	53.29	50.270	-0.045	-11	03	18.62	-0.590	-0.122
688	6869	η Serpentis	3.26	275	57	42.70	49.650	-0.614	+20	25	44.42	-1.140	-0.677
692	6913	λ Sagittarii	2.81	276	36	11.60	50.250	-0.053	-2	08	21.50	-0.650	-0.183
697	6951	θ Coronae Aust.	4.64	276	49	50.80	50.360	+0.031	-19	03	57.90	-0.480	-0.024
1482	6973	α Scuti	3.85	279	18	09.20	50.230	-0.037	+14	54	56.82	-0.770	-0.310
214	1953	γ Mensae	5.19	279	51	15.42	50.810	+1.082	-79	59	19.24	-0.760	+0.239
1487	7039	φ Sagittarii	3.17	280	28	05.15	50.360	+0.053	-3	57	23.85	-0.460	-0.004
1489	7063	β Scuti	4.22	282	39	58.26	50.250	-0.006	+18	11	00.04	-0.460	-0.016
706	7121	σ Sagittarii*	2.02	282	40	18.51	50.320	+0.008	-3	27	08.65	-0.500	-0.055
710	7150	ξ^2 Sagittarii	3.51	283	44	15.61	50.320	+0.032	+1	39	30.97	-0.460	-0.015

* **No. 652 : *Schaula* , Mula.** **No. 706 : *Nunki* , Uttarasadha.**

No. 687 : Purvasadha-1.

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2020.5

MEAN PLACES FOR JULY 2^{d}.125 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude °	′	″	Annual Variation ″	Annual Proper Motion ″	Latitude °	′	″	Annual Variation ″	Annual Proper Motion ″
1496	7234	τ Sagittarii	3.32	285	07	13.06	50.230	-0.083	-5	05	34.01	-0.690	-0.243
699	7001	α Lyrae	0.03	285	36	13.90	50.490	+0.505	+61	43	54.39	-0.190	+0.256
720	7264	π Sagittarii	2.89	286	32	17.38	50.290	-0.004	+1	26	03.68	-0.480	-0.035
717	7236	λ Aquilae	3.44	287	37	05.71	50.200	-0.029	+17	33	45.99	-0.530	-0.087
754	7665	δ Pavonis	3.56	287	54	25.71	51.620	+1.142	-44	42	36.34	-1.880	-1.444
712	7176	ε Aquilae	4.02	288	32	50.02	50.070	-0.075	+37	33	52.14	-0.500	-0.066
705	7106	β Lyrae	var.	289	10	06.73	50.010	+0.005	+55	58	54.07	-0.430	-0.003
810	8254	ν Octantis	3.76	289	58	32.53	50.400	-0.212	-57	46	58.95	-0.650	-0.217
716	7235	ζ Aquilae	2.99	290	04	53.22	50.120	-0.023	+36	10	57.78	-0.530	-0.094
713	7178	γ Lyrae	3.24	292	12	25.12	49.990	-0.003	+55	00	38.12	-0.420	+0.003
775	7913	β Pavonis	3.42	292	46	53.45	50.470	-0.055	-45	57	24.57	-0.390	+0.028
730	7377	δ Aquilae	3.36	293	55	30.74	50.490	+0.294	+24	48	53.75	-0.370	+0.040
764	7790	α Pavonis	1.94	294	06	16.77	50.440	-0.025	-36	16	13.75	-0.500	-0.087
751	7623	θ^1 Sagittarii	4.37	295	09	24.35	50.350	+0.001	-14	23	17.49	-0.440	-0.027
785	7986	β Indi	3.65	298	04	23.63	50.510	+0.008	-39	09	34.15	-0.430	-0.030
769	7869	α Indi	3.11	299	23	30.66	50.510	+0.078	-27	45	20.18	-0.340	+0.048
1508	7405	α Vulpeculae	4.44	299	47	28.41	49.810	-0.209	+45	51	20.46	-0.470	-0.076
746	7570	η Aquilae	var.	300	43	10.48	50.190	+0.010	+21	31	15.72	-0.400	-0.009
741	7525	γ Aquilae	2.72	301	13	28.25	50.140	+0.020	+31	14	28.96	-0.390	-0.005
11	98	β Hydri	2.8	301	16	34.17	53.530	+2.664	-64	47	52.75	-2.310	-1.952
1513	7488	β Sagittae	4.37	301	29	28.16	50.070	+0.003	+38	12	56.80	-0.410	-0.033
732	7417	β Cygni *p*	3.08	301	32	10.75	49.970	+0.002	+48	57	55.84	-0.380	-0.002
745	7557	α Aquilae*	0.77	302	03	57.20	50.830	+0.697	+29	18	10.19	-0.110	+0.262
749	7602	β Aquilae	3.71	302	42	31.95	50.080	-0.064	+26	39	15.37	-0.850	-0.481
743	7536	δ Sagittae	3.82	303	40	20.39	50.070	+0.011	+38	54	38.72	-0.360	+0.006
761	7754	α^2 Capricorni	3.57	304	08	42.57	50.320	+0.063	+6	55	40.90	-0.380	-0.011
762	7776	β Capricorni	3.08	304	20	02.01	50.320	+0.042	+4	35	11.50	-0.370	-0.008
756	7710	θ Aquilae	3.23	305	35	54.09	50.220	+0.041	+20	19	30.08	-0.370	-0.005
752	7635	γ Sagittae	3.47	307	19	44.64	50.120	+0.090	+39	11	17.79	-0.350	+0.006
1550	8039	γ Microscopii	4.67	308	43	06.04	50.380	-0.000	-14	40	02.00	-0.340	+0.006
841	8502	α Tucanae	2.86	309	57	32.37	50.510	-0.120	-45	24	20.47	-0.340	-0.000
146	1208	γ Hydri	3.24	310	46	09.98	52.140	+0.537	-76	45	33.29	-0.410	-0.010
781	7950	ε Aquarii	3.77	312	00	34.12	50.280	+0.024	+8	04	42.50	-0.360	-0.042
1547	7990	μ Aquarii	4.73	313	20	39.85	50.280	+0.035	+8	14	16.67	-0.350	-0.041
768	7852	ε Delphini	4.03	314	20	46.93	50.100	+0.007	+29	04	16.55	-0.340	-0.024
726	7328	κ Cygni	3.77	315	11	59.36	49.440	+0.396	+73	48	03.60	-0.220	+0.080
829	8425	α Gruis	1.74	316	11	42.45	50.590	+0.064	-32	54	57.83	-0.480	-0.191
(771)	7882	β Delphini m*	3.64	316	37	36.56	50.130	+0.070	+31	54	57.19	-0.370	-0.069
806	8204	ζ Capricorni	3.74	317	13	25.03	50.350	+0.008	-6	59	32.91	-0.260	+0.022
774	7906	α Delphini	3.77	317	39	57.65	50.120	+0.074	+33	01	13.86	-0.310	-0.022
822	8353	γ Gruis	3.01	317	42	25.75	50.550	+0.095	-23	03	08.15	-0.350	-0.058

* **No. 745 : *Altair* , Sravana.** **No. 771 : *Rotanev* , Dhanistha-1.**

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2020.5

MEAN PLACES FOR JULY 2^{d}.125 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude °	'	"	Annual Variation "	Annual Proper Motion "	Latitude °	'	"	Annual Variation "	Annual Proper Motion "
733	7420	ι Cygni	3.79	318	14	59.92	49.420	+0.252	+71	27	00.18	-0.180	+0.104
778	7928	δ Delphini	4.43	318	24	04.01	50.020	-0.037	+31	56	30.53	-0.310	-0.035
1541	7948	γ Delphini sq	4.27	319	39	10.44	49.940	-0.109	+32	41	59.05	-0.450	-0.177
860	8675	ε Gruis	3.49	321	01	07.09	50.700	+0.077	-39	47	23.87	-0.370	-0.115
846	8556	δ' Gruis	3.97	321	53	25.46	50.570	+0.027	-31	20	56.42	-0.270	-0.017
812	8278	γ Capricorni	3.68	322	04	41.71	50.480	+0.172	-2	33	33.31	-0.340	-0.084
856	8636	β Gruis	2.11v	322	36	58.12	50.720	+0.145	-35	26	02.30	-0.330	-0.071
800	8131	α Equulei	3.92	323	24	10.70	50.170	+0.029	+20	07	11.46	-0.350	-0.102
808	8232	β Aquarii	2.91	323	40	52.44	50.250	+0.017	+8	36	48.66	-0.260	-0.015
819	8322	δ Capricorni	2.87	323	49	47.69	50.470	+0.149	-2	36	18.63	-0.610	-0.368
1569	8264	ξ Aquarii	4.69	324	24	18.94	50.350	+0.103	+5	57	21.42	-0.310	-0.062
765	7796	γ Cygni	2.2	325	07	27.73	49.670	+0.007	+57	07	23.08	-0.230	-0.001
780	7949	ε Cygni	2.46	328	01	59.64	50.510	+0.705	+49	25	18.89	-0.060	+0.155
815	8308	ε Pegasi	var.	332	10	13.77	50.150	+0.031	+22	05	55.47	-0.200	-0.011
849	8592	ν Aquarii	5.2	332	49	48.58	50.530	+0.154	-10	54	11.55	-0.390	-0.218
797	8115	ζ Cygni	3.2	333	19	30.96	49.840	-0.031	+43	41	36.38	-0.230	-0.051
827	8414	α Aquarii	2.96	333	52	13.26	50.220	+0.015	+11	15	29.98	-0.190	-0.016
867	8728	α PsA	1.16	334	08	56.69	50.720	+0.253	-21	08	17.65	-0.450	-0.287
777	7924	α Cygni	1.25	335	36	40.75	49.540	+0.007	+59	54	18.98	-0.160	+0.001
842	8518	γ Aquarii	3.84	337	00	02.82	50.350	+0.126	+8	14	02.68	-0.190	-0.042
834	8450	θ Pegasi	3.53	337	07	13.14	50.440	+0.278	+16	20	21.63	-0.220	-0.077
861	8679	τ Aquarii	4.01	338	52	56.12	50.320	-0.026	-5	39	55.60	-0.160	-0.030
866	8709	δ Aquarii	3.27	339	09	35.91	50.310	-0.047	-8	11	31.67	-0.140	-0.008
3	25	ε Phoenicis	3.88	339	56	12.72	50.720	+0.011	-41	57	28.89	-0.350	-0.220
850	8597	η Aquarii	4.02	340	46	42.65	50.300	+0.064	+8	21	48.87	-0.210	-0.087
792	8079	ξ Cygni	3.72	341	04	55.37	49.620	+0.014	+56	34	52.89	-0.120	-0.003
864	8698	λ Aquarii*	3.74	341	51	45.49	50.320	+0.025	-0	23	13.46	-0.080	+0.030
72	591	α Hydri	2.86	342	24	44.21	51.660	+0.420	-64	14	37.86	-0.300	-0.194
831	8430	ι Pegasi	3.76	344	41	42.84	50.320	+0.339	+34	15	15.78	-0.190	-0.104
54	472	α Eridani	0.46	345	36	09.69	51.160	+0.084	-59	22	44.76	-0.170	-0.092
12	99	α Phoenicis	2.39	345	46	55.61	50.650	-0.042	-40	38	09.83	-0.520	-0.444
855	8634	ζ Pegasi	3.4	346	26	15.38	50.220	+0.072	+17	40	43.62	-0.110	-0.043
141	1175	β Reticuli	3.85	351	41	47.56	52.990	+0.795	-76	05	22.95	-0.290	-0.260
878	8852	γ Piscium	3.69	351	44	36.02	50.950	+0.713	+7	15	19.11	-0.310	-0.285
871	8781	α Pegasi	2.49	353	46	16.69	50.170	+0.043	+19	24	20.07	-0.070	-0.065
1044	440	δ Phoenicis	3.95	353	54	49.96	51.250	+0.337	-52	34	57.05	+0.030	+0.035
862	8684	μ Pegasi	3.48	354	40	17.63	50.160	+0.130	+29	23	10.57	-0.110	-0.102
857	8650	η Pegasi	2.94	355	59	52.00	49.960	+0.002	+35	06	28.98	-0.020	-0.029
68	566	χ Eridani	3.7	356	32	43.08	52.320	+1.308	-57	01	06.79	-0.190	-0.210
49	429	γ Phoenicis	3.41	358	25	54.41	50.630	-0.186	-47	35	09.06	-0.140	-0.167
870	8775	β Pegasi*	2.42v	359	39	37.89	50.280	+0.270	+31	08	27.40	+0.070	+0.037

* **No. 864 : Satabhisaj.** **No. 870 : *Scheat*, Purva Bhadrapada-2.**

BS = Bright Star Catalogue HR = Havard Revised Catalogue FK5 = Fifth Fundamental Catalogue

MEAN PLACES OF STARS, J 2020.5

FOR JULY 2^{d}.125 TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec-tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
1	15	α Andromedae∗	2.06	B9 II	0	09	27.1	3.117	+104	+29	12	12.79	+19.86	-163
2	21	β Cassiopeiae∗	2.27	F2 IV	0	10	17.1	3.245	+685	+59	15	45.97	19.84	-181
3	25	ε Phoenicis	3.88	K0 III	0	10	26.7	3.025	+118	-45	38	04.02	19.84	-181
7	39	γ Pegasi*	2.83	B2 IV	0	14	17.6	3.098	+2	+15	17	50.68	19.99	-12
9	74	ι Ceti	3.56	K1.5 III	0	20	28.3	3.056	-9	-8	42	37.57	19.93	-36
11	98	β Hydri	2.80	G0V	0	26	48.0	3.056	+6633	-77	08	20.60	20.23	+324
12	99	α Phoenicis	2.39	K0.5 III b	0	27	17.5	2.950	+183	-42	11	41.86	+19.50	-396
17	153	ζ Cassiopeiae	3.66	B2 IV	0	38	07.5	3.382	+22	+54	00	34.10	19.76	-9
20	165	δ Andromedae	3.27	K3 III	0	40	25.8	3.227	+106	+30	58	22.21	19.64	-92
21	168	α Cassiopeiae∗	2.23	K0- IIIa	0	41	41.0	3.449	+64	+56	38	58.08	19.68	-32
22	188	β Ceti∗	2.04	K0III	0	44	37.1	3.008	+164	-17	52	27.87	19.70	+32
33	269	μ Andromedae	3.87	A5 V	0	57	53.9	3.355	+130	+38	36	38.16	19.44	+33
32	264	γ Cassiopeiae∗	2.47	B0 IVpe	0	57	57.8	3.678	+36	+60	49	36.35	+19.40	-5
35	280	α Sculptoris	4.31	B7IIIp	0	59	35.5	2.885	+17	-29	14	49.53	19.37	+4
40	334	η Ceti	3.45	K1 III	1	09	37.3	3.019	+147	-10	04	26.68	18.99	-138
42	337	β Andromedae*	2.06	M0III	1	10	53.2	3.382	+146	+35	43	43.30	18.98	-114
1033	361	ζ Piscium∗	5.24	A7IV	1	14	48.3	3.143	+97	+7	40	59.50	18.93	-56
47	402	θ Ceti	3.60	K0 III	1	25	02.9	3.001	-53	-8	04	41.54	18.46	-218
48	403	δ Cassiopeiae	2.68	A5 III-IVv	1	27	10.5	3.987	+400	+60	20	27.86	+18.56	-52
49	429	γ Phoenicis	3.41	Mo- IIIa	1	29	15.2	2.597	-13	-43	12	49.53	18.33	-208
1044	440	δ Phoenicis	3.95	G9 III	1	32	06.2	2.489	+144	-48	58	00.24	18.60	+151
50	437	η Piscium	3.62	G7 IIa	1	32	35.0	3.222	+19	+15	27	02.88	18.42	-6
54	472	α Eridani∗	0.46	B6Vep	1	38	28.5	2.226	+117	-57	07	59.09	18.18	-35
52	464	51 Andromedae	3.57	K3 III	1	39	15.7	3.721	+65	+48	43	52.63	18.08	-113
59	509	τ Ceti	3.50	G8.5 V	1	45	01.3	2.789	-1190	-15	49	48.46	+18.83	+858
62	539	ζ Ceti	3.73	K0 III	1	52	28.4	2.964	+28	-10	14	04.20	17.64	-39
64	544	α Trianguli	3.41	F5III	1	54	15.4	3.440	+9	+29	40	40.36	17.37	-235
66	553	β Arietis∗	2.64	A5 V	1	55	46.6	3.329	+68	+20	54	11.95	17.43	-111
63	542	ε Cassiopeiae	3.38	B3III	1	55	53.6	4.394	+48	+63	46	26.58	17.51	-21
68	566	χ Eridani	3.70	G8IV	1	56	45.2	2.329	+730	-51	30	26.97	17.79	+291
72	591	α Hydri	2.86	F0IV	1	59	24.9	1.889	+368	-61	28	14.26	+17.41	+26
71	585	ν Ceti	4.00	F7III	2	00	58.3	2.827	+97	-20	58	45.31	17.29	-24
73	603	γ Andromed.∗ p	2.26	K3- IIB	2	05	10.0	3.714	+40	+42	25	09.02	17.07	-52
70	580	50 Cassiopeiae	3.98	A2V	2	05	13.7	5.270	-99	+72	31	37.62	17.15	+22
74	617	α Arietis∗	2.00	K2 III	2	08	20.0	3.399	+138	+23	33	30.29	16.83	-149
75	622	β Trianguli	3.00	A5 III	2	10	46.2	3.594	+122	+35	04	59.78	16.83	-40
82	674	φ Eridani	3.56	B8IV- V	2	17	14.5	2.142	+102	-51	25	04.85	+16.53	-27
79	664	γ Trianguli	4.01	A1Vnn	2	18	32.4	3.590	+38	+33	56	27.63	16.44	-51
91	779	δ Ceti	4.07	B2 IV	2	40	32.1	3.083	+9	+0	24	59.95	+15.32	-4

∗ **No. 1 : *Alpheratz*, Uttara Bhadrapada - 2**
No. 2 : *Caph*
No. 7 : *Algenib*, Uttara Bhadrapada - 1
No. 21 : *Schedar* . Mag. 2.1 to 2.6
No. 22 : *Deneb Kaitos or Diphda*
No. 32 : *Cih* . Mag. 1.6 to 3.2
No. 42 : *Mirach*
No. 1033 : Revati
No. 54 : *Achernar*
No. 66 : *Sheratan*, Asvini
No. 73 : *Almach*, Mag. f. 5.1
No. 74 : *Hamal*

MEAN PLACES OF STARS, J 2020.5

FOR JULY 2^{d}.125 TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spectral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
1075	794	ι Eridani	4.11	K0III	2	41	28.6	2.367	+120	-39	46	57.23	+15.24	-32
94	801	35 Arietis	4.66	B3 V	2	44	39.6	3.539	+6	+27	47	06.69	15.08	-12
101	841	β Fornacis	4.46	G8 5 IIIb	2	49	56.9	2.512	+71	-32	19	35.46	14.93	+155
100	838	41 Arietis*	3.63	B8 Vn	2	51	11.8	3.550	+50	+27	20	14.71	14.59	-118
99	834	η Persei	3.76	K31b	2	52	12.5	4.429	+20	+55	58	37.61	14.63	-14
103	854	τ Persei	3.95	G4 III+	2	55	43.5	4.299	-0	+52	50	41.65	+14.43	-5
104	874	η Eridani	3.89	K1 III	2	57	25.8	2.936	+53	-8	49	03.51	14.11	-220
907	424	α Ursae Mins.*	2.02	F7:Ib-Iiv	2	57	48.5	85.762	+2140	+89	20	44.67	14.29	-19
106	897	θ Eridani* p	3.25	A3 IV-V	2	59	02.3	2.276	-39	-40	13	24.34	14.25	+19
1085	919	τ˘ Eridani	4.09	A3IV- V	3	03	17.8	2.647	-105	-23	32	08.26	13.91	-53
107	911	α Ceti*	2.53	M1.5 IIIa	3	03	21.2	3.145	-6	+4	10	42.19	13.88	-78
108	915	γ Persei	2.93	G8 III+	3	06	17.7	4.391	0	+53	35	06.61	13.77	-5
109	921	ρ Persei*	3.39	M4 II	3	06	29.9	3.871	+111	+38	55	05.88	+13.66	-106
111	936	β Persei*	2.12	B8V	3	09	30.6	3.931	+3	+41	01	59.52	13.57	-1
120	1017	α Persei*	1.79	F5 Iab	3	25	47.8	4.320	+25	+49	55	56.92	12.47	-25
121	1030	ο Tauri	3.60	G6 III	3	25	55.2	3.238	-45	+9	05	58.93	12.40	-78
123	1038	ξ Tauri	3.74	B9 Vn	3	28	17.0	3.261	+40	+9	48	10.27	12.28	-39
127	1084	ε Eridani	3.73	K2 Vk	3	33	53.9	2.832	-658	-9	23	24.04	11.95	+23
135	1136	δ Eridani	3.54	B1III-IV	3	44	13.9	2.880	-61	-9	41	04.86	+11.94	+745
131	1122	δ Persei	3.01	B5 III	3	44	23.6	4.303	+28	+47	51	42.84	11.14	-34
141	1175	β Reticuli	3.85	K2 III	3	44	27.8	0.773	+490	-64	44	34.27	11.25	+75
136	1142	17 Tauri	3.70	B6 IIIe	3	46	05.8	3.577	+14	+24	10	34.60	11.01	-46
134	1135	ν Persei	3.77	F5 Iab	3	46	35.7	4.102	-13	+42	38	29.60	11.02	-2
146	1208	γ Hydri	3.24	M2 III	3	46	56.6	-0.855	+116	-74	10	32.79	11.11	+114
139	1165	η Tauri*	2.87	B7 III	3	48	42.4	3.581	+14	+24	10	01.07	+10.82	-46
142	1178	27 Tauri	3.63	B8 III	3	50	23.1	3.582	+13	+24	06	52.38	10.69	-47
144	1203	ζ Persei	2.85	B1 Ib	3	55	25.5	3.789	+4	+31	56	34.29	10.35	-10
149	1231	γ Eridani	2.95	M 1 IIIb	3	58	59.2	2.803	+42	-13	27	03.88	9.99	-112
147	1220	ε Persei	2.89	B 0.5 V+	3	59	14.2	4.048	+16	+40	04	05.25	10.05	-26
148	1228	ξ Persei	4.04	O 7.5 IIIe	4	00	18.0	3.912	+2	+35	50	53.59	10.00	0
150	1239	λ Tauri	3.47v	B3 V+	4	01	49.1	3.334	-4	+12	32	48.48	+9.87	-12
151	1251	ν Tauri	3.91	A0.5 Va	4	04	14.9	3.200	+3	+6	02	41.07	9.69	-3
152	1273	48 Persei	4.04	B3 Ve	4	10	09.5	4.383	+20	+47	45	55.12	9.21	-31
155	1326	α Horologii	3.86	K2 III	4	14	41.0	1.992	+41	-42	14	41.50	8.68	-209
156	1336	α Reticuli	3.35	G8II-III	4	14	41.6	0.789	+65	-62	25	22.50	8.93	+45
159	1346	γ Tauri	3.65	K0III	4	20	57.8	3.424	+80	+15	40	31.92	8.37	-25
162	1373	δ Tauri	3.76	K0III	4	24	07.2	3.470	+75	+17	35	20.26	+8.11	-30
1121	1393	43 Eridani	3.96	K4 III	4	24	48.5	2.257	+56	-33	58	13.30	8.14	+50
164	1409	ε Tauri	3.54	G9.5 III	4	29	49.0	3.513	+76	+19	13	27.21	7.65	-38
171	1465	α Doradus	3.27	A0IIIs	4	34	26.5	1.304	+60	-55	00	12.07	7.31	-4
170	1464	*ν*ˊ Eridani	3.82	G8IIIa	4	36	20.9	2.336	-35	-30	31	17.35	+7.14	-12

* **No. 907 : (Nb) : *Polaris*, Dhruva**
No. 100 : Bharani
No. 106 : Acamar.
No. 107 : *Menkar*
No. 109 : Mag. 3.3 to 4.0.

No. 111 : *Algol*, Mag. 2.1 to 3.4.
No. 120 : *Mirphak.*
No. 139 : *Alcyone*, Krittika.

MEAN PLACES OF STARS, J 2020.5

FOR JULY $2^d.125$ TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec- tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
168	1457	α Tauri*	0.85	K5III	4	37	06.0	3.451	+44	+16	32	55.89	+6.90	-190
172	1481	53 Eridani	3.87	K1III	4	39	07.2	2.751	-52	-14	15	54.52	6.77	-155
1129	1502	α Caeli	4.45	F2 V	4	41	13.4	1.937	-126	-41	49	32.29	6.68	-77
1134	1543	π^3 Orionis	3.19	F6 V	4	50	57.3	3.263	+313	+6	59	43.64	5.96	+11
179	1552	π^4 Orionis	3.69	B2 III+	4	52	18.0	3.201	-1	+5	38	18.87	5.84	+1
180	1567	π^5 Orionis	3.72	B3 III+	4	55	19.3	3.131	0	+2	28	28.59	5.58	0
178	1542	α Camelopardi	4.29	O9.5 I ae	4	56	06.1	6.012	-1	+66	22	21.67	+5.52	+6
181	1577	ι Aurigae	2.69	K3 II	4	58	19.9	3.918	+3	+33	11	47.94	5.31	-18
183	1605	ε Aurigae*	2.99V	A8 Iab	5	03	26.7	4.320	-1	+43	51	05.40	4.89	-4
1137	1612	ζ Aurigae	3.75	K4Ib-II+	5	03	54.9	4.207	+8	+41	06	13.30	4.83	-22
182	1603	β Camelopardi	4.03	G1Ib-II	5	05	15.0	5.366	-9	+60	28	10.53	4.73	-16
186	1654	ε Leporis	3.19	K4 III	5	06	19.8	2.543	+18	-22	20	41.22	4.58	-74
185	1641	η Aurigae	3.17	B3 V	5	07	57.4	4.220	+26	+41	15	36.52	+4.44	-68
188	1666	β Eridani*	2.79	A3III	5	08	51.5	2.954	-63	-5	03	41.08	4.35	-81
1144	1702	μ Leporis	3.31	B9IV	5	13	51.2	2.698	+30	-16	10	57.52	3.98	-26
194	1713	β Orionis*	0.12	B8 Iab	5	15	31.4	2.887	0	-8	10	45.91	3.86	-1
193	1708	α Aurigae*	0.08	G5IIIe+	5	18	12.4	4.444	+72	+46	01	00.04	3.21	-425
195	1735	τ Orionis	3.60	B5 III	5	18	36.2	2.917	-10	-6	49	25.34	3.59	-8
1147	1765	22 Orionis	4.73	B2IV-V	5	22	49.0	3.085	0	-0	23	49.78	+3.24	-1
201	1790	γ Orionis*	1.64	B2 III	5	26	13.9	3.222	-6	+6	21	59.75	2.93	-14
202	1791	β Tauri*	1.65	B7 III	5	27	35.4	3.799	+17	+28	37	22.14	2.65	-175
204	1829	β Leporis	2.84	G5 II	5	29	07.5	2.574	-3	-20	44	39.94	2.60	-89
214	1953	γ Mensae	5.19	K2 III	5	31	04.9	-2.340	+320	-76	19	30.87	2.80	+282
206	1852	δ Orionis*	2.23	O9.5 II+	5	33	03.6	3.083	+1	0	18	07.80	2.35	-2
207	1865	α Leporis*	2.58	F0 Ib	5	33	38.1	2.649	+1	-17	48	32.25	+2.30	+2
212	1922	β Doradus	3.76v	F6Ia	5	33	48.3	0.528	+3	-62	28	36.28	2.29	+9
(GC)	1879	λ Orionis*	3.54	O8 III	5	36	16.1	3.308	-1	+9	56	46.41	2.07	-2
209	1899	ι Orionis	2.77	O9 III	5	36	26.2	2.938	0	-5	53	52.52	2.06	+1
210	1903	ε Orionis*	1.70	B0 Iab	5	37	15.3	3.048	+1	-1	11	25.43	1.98	-2
211	1910	ζ Tauri	3.00	B2IV	5	38	52.3	3.590	0	+21	09	11.55	1.82	-21
215	1956	α Columbae*	2.64	B7 IVe	5	40	23.5	2.176	+5	-34	03	51.78	+1.69	-26
1154	2015	δ Doradus	4.35	A7V	5	44	48.7	0.114	-49	-65	43	34.82	1.34	+8
217	1983	γ Leporis	3.60	F6 V	5	45	19.1	2.503	-212	-22	26	40.54	0.91	-369
219	1998	ζ Leporis	3.55	A2 IV-V(n)	5	47	53.1	2.721	-11	-14	48	56.59	1.06	-1
220	2004	κ Orionis*	2.06	B0Iab	5	48	43.8	2.848	+1	-9	39	49.73	0.98	-2
223	2040	β Columbae	3.12	K1 IIICN+1	5	51	41.0	2.119	+49	-35	45	42.41	1.13	+401
222	2035	δ Leporis	3.81	K1IVFe	5	52	12.2	2.582	+161	-20	52	43.43	+0.03	-649
224	2061	α Orionis*	0.5	M2Iab	5	56	16.9	3.251	+17	+7	24	33.19	+0.33	+9

No. 168 : *Aldebaran,* Rohini
* **No. 183 : Mag. 2.9 to 3.8.**
No. 188 : *C ursa* .
No. 194 : *Rigel.*
No. 193 : *Capella* , Brahmahridaya.
No. 201 : *Bellatrix.*
No. 202 : *El Nath* , Agni.
No. 206 : *Mintaka* .

No. 207 : *Arneb* .
No. GC : *Mrgasiras* .
No. 210 : *Alnilam.*
No. 215 : *Phakt* .
No. 220 : *Saiph* .
No. 224 : *Betelgeuse* , Mag. 0.4 to 1.3 Ardra.

MEAN PLACES OF STARS, J 2020.5

FOR JULY 2^{d}.125 TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec- tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
226	2085	η Leporis	3.71	F2 V	5	57	20.4	2.735	-28	-14	09	55.41	+0.37	+139
229	2120	η Columbae	3.96	K01II	5	59	46.5	1.839	+20	-42	48	54.16	+0.01	-14
227	2088	β Aurigae*	1.90	A2IV+	6	01	02.0	4.404	-54	+44	56	50.28	-0.09	0
225	2077	δ Aurigae*	3.72	K0 III	6	01	13.0	4.943	+92	+54	17	01.71	0.23	-126
1163	2134	1 Geminorum	4.16	G5III	6	05	22.0	3.649	-6	+23	15	37.61	0.57	-100
1168	2219	κ Aurigae	4.35	G8.5IIIb	6	16	41.1	3.823	-57	+29	29	18.86	1.72	-262
240	2282	ζ Canis Maj.	3.02	B2.5V	6	21	06.1	2.306	+7	-30	04	25.28	-1.84	+3
243	2294	β Canis Maj.*	1.98	B1 II/III	6	23	36.2	2.644	-4	-17	58	02.80	2.06	0
241	2286	μ Geminorum	2.88	M3 III	6	24	12.0	3.630	+39	+22	30	04.31	2.22	-111
245	2326	α Carinae*	-0.72	F0II	6	24	24.5	1.333	+25	-52	42	50.96	2.11	+21
244	2298	8ε Monocerotis	4.44	A5 IV	6	24	51.3	3.181	-12	+4	34	27.34	2.16	+11
1173	2343	ν Geminorum	4.15	B6 IIIe	6	30	10.8	3.562	-5	+20	11	50.41	2.65	-14
252	2451	ν Puppis	3.17	B8 III	6	38	23.3	1.838	+2	-43	12	48.23	-3.35	-6
251	2421	γ Geminorum*	1.93	A0 IV	6	38	53.8	3.465	+29	+16	22	53.57	3.43	-42
254	2473	ε Geminorum	2.98	G8 Ib	6	45	11.6	3.689	-4	+25	06	32.25	3.94	-13
257	2491	α Canis Maj* cg	-1.46	A1V	6	46	03.0	2.643	-386	-16	44	43.90	5.20	-1204
256	2484	ξGeminorum	3.36	F5 IV	6	46	26.4	3.366	-79	+12	52	18.42	4.22	-191
262	2550	α Pictoris	3.27	A8VmkA6	6	48	24.0	0.612	-96	-61	57	49.38	3.93	+269
263	2553	τ Puppis	2.93	K1 III	6	50	26.7	1.490	+38	-50	38	59.84	-4.45	-70
1180	2538	κ Canis Maj.	3.96	B1.5IVe	6	50	36.4	2.243	-5	-32	31	23.42	4.39	+4
261	2540	θ Geminorum	3.60	A3III	6	54	08.3	3.949	-2	+33	56	04.47	4.74	-48
268	2618	ε Canis Maj.*	1.50	B2 Iab	6	59	25.9	2.360	+3	-29	00	04.10	5.14	+3
1183	2646	σ Canis Maj.	3.47	M1.5Iab	7	02	32.2	2.392	-4	-27	57	55.37	5.40	+5
270	2653	o^2 Canis Maj.	3.02	B3 Ia	7	03	52.8	2.507	-3	-23	51	52.20	5.51	+3
269	2650	ζ Geminorum*	3.79v	G0Ibv	7	05	19.4	3.555	-6	+20	32	18.51	-5.64	0
1189	2736	γ^2 Volantis	3.78	K0III	7	08	34.0	-0.532	+47	-70	31	36.97	5.80	+106
273	2693	δ Canis Maj.	1.86	F8 Iab	7	09	13.5	2.441	-2	-26	25	55.41	5.96	+4
1187	2714	22δ Monocerotis	4.15	A2V	7	12	55.1	3.085	-1	-0	26	41.50	6.26	+5
281	2803	δ Volantis	3.98	F6II	7	16	48.9	-0.048	-12	-67	59	41.09	6.59	+5
278	2773	π Puppis	2.70	K3Ib	7	17	52.0	2.121	-8	-37	08	07.31	6.67	+4
277	2763	λ Geminorum	3.58	A3V	7	19	16.2	3.444	-33	+16	30	06.26	-6.83	-37
279	2777	δ Geminorum	3.53	F0 IV	7	21	20.7	3.578	-19	+21	56	34.28	6.98	-12
283	2827	η Canis Maj.	2.45	B5 Ia	7	24	54.4	2.375	-3	-29	20	39.20	7.25	+5
282	2821	ι Geminorum	3.79	G9 IIIb	7	26	59.9	3.719	-93	+27	45	20.03	7.51	-86
285	2845	β Canis Min.*	2.90	B8Ve	7	28	15.7	3.251	-35	+8	14	47.29	7.57	-38
1194	2878	ρ Puppis	3.25	K5 III	7	29	52.9	1.905	-50	-43	20	37.96	7.47	+187
287	2891	α Gemino.* *cg*	1.95	A2Vm	7	35	54.3	3.820	-135	+31	50	30.62	-8.24	-98
291	2943	α C. Min.* *cg*	0.38	F5 IV-V	7	40	22.4	3.137	-477	+5	10	15.73	9.52	-1022
297	3024	ζ Volantis	3.95	K0III	7	41	33.3	-0.783	+67	-72	39	01.04	-8.57	+18

* **No. 225 : Prajapati.**
No. 227 : *Menkalinam* .
No. 243 : *Mirzam.*
No. 245 : *Canopus* , Agastya.
No. 251 : *Alhena* .

No. 257 : *Sirius* , Lubdhaka Mag. - 1.46.
No. 268 : *Adhara.*
No. 269 : Mekbuda Mag. 3.7 to 4.1.
No. 285 : *Gomeisa.*
No. 287 : *Castor*, Punarvasu-2, Mag. 1.95 & 2
No. 291 : *Procyon* , Mag. 0.38 & 11.3.

MEAN PLACES OF STARS, J 2020.5

FOR JULY 2^{d}.125 TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec-tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
293	2970	26α Monocerotis	3.93	G9 III	7	42	13.6	2.867	-49	-9	36	17.84	-8.66	-19
294	2985	κ Geminorum	3.57	G8 III	7	45	41.0	3.614	-24	+24	20	49.82	8.97	-52
295	2990	β Geminorum*	1.14	K0IIIb	7	46	34.1	3.662	-474	+27	58	30.10	9.03	-45
1204	3045	ξ Puppis	3.34	G6 Ia	7	50	09.4	2.525	-2	-24	54	44.63	9.27	-2
301	3080	213 G. Puppis	3.73	K1/2II+	7	52	55.4	2.064	-8	-40	37	46.82	9.48	+3
303	3117	χ Carinae	3.47	B3IVp	7	57	18.0	1.524	-32	-53	02	16.82	9.79	+21
306	3165	ζ Puppis	2.25	O4If(m)p	8	04	18.3	2.111	-24	-40	03	42.92	-10.33	+12
308	3185	ρ Puppis	2.81	F6IIp	8	08	25.1	2.557	-61	-24	21	52.14	10.60	+49
309	3207	γ² Velorum	1.78	WC8+O7.5	8	10	09.9	1.850	-4	-47	23	52.31	10.77	+6
312	3249	β Cancri	3.52	K 3:IIIv	8	17	37.6	3.249	-30	+9	07	15.56	11.37	-49
315	3307	ε Carinae	1.86	K2III	8	22	56.0	1.225	-35	-59	34	33.86	11.69	+14
319	3347	β Volantis	3.77	K2 III	8	25	57.2	0.633	-60	-66	12	28.26	12.07	-155
316	3314	Br 1197 Hydrae	3.90	A0V	8	26	41.1	2.996	-44	-3	58	20.36	-11.99	-23
317	3323	*o* Ursae Maj.	3.36	G5 III	8	31	57.1	4.930	-182	+60	38	51.55	12.44	-107
321	3366	η Cancri	5.33	K3 III	8	33	53.5	3.460	-34	+20	22	12.48	12.51	-43
1223	3410	δ Hydrae	4.16	A1Vnn	8	38	44.4	3.172	-44	+5	37	51.68	12.80	-7
1224	3418	σ Hydrae	4.44	K1 III	8	39	49.7	3.133	-12	+3	16	05.47	12.89	-18
1227	3447	*o* Velorum	3.62	B3 IV	8	40	52.8	1.719	-24	-52	59	43.60	12.92	+20
1226	3445	53 G. Velorum	3.84	F3 Ia	8	41	18.5	1.994	0	-46	43	20.93	-12.97	+3
327	3468	α Pyxidis	3.68	B1.5 III	8	44	25.0	2.414	-9	-33	15	36.33	13.17	+11
1228	3449	γ Cancri	4.66	A1IV	8	44	28.1	3.462	-76	+21	23	40.36	13.22	-39
326	3461	δ Cancri*	3.94	K0 III	8	45	50.8	3.401	-13	+18	04	39.51	13.50	-228
(329)	3482	ε Hydrae* m	3.38	G5III	8	47	51.5	3.170	-155	+6	20	00.80	13.44	-40
328	3475	ι Cancri	4.02	G8Iab	8	47	56.0	3.617	-19	+28	41	32.88	13.45	-42
336	3571	108 G. Carinae	3.84	B8.5II	8	55	30.6	1.355	-28	-60	43	24.43	-13.85	+38
334	3547	ζ Hydrae	3.11	G9 II-III	8	56	28.6	3.167	-66	+5	51	58.85	13.94	+15
337	3572	α Cancri*	4.25	A5 m	8	59	36.4	3.275	+23	+11	46	37.84	14.18	-31
335	3569	ι Ursae Maj.	3.14	A7 V	9	00	36.1	4.076	-443	+47	57	35.05	14.43	-225
342	3614	97 G. Velorum	3.75	K2 III	9	04	51.8	2.073	-44	-47	10	26.50	14.48	-13
341	3594	κ Ursae Maj.	3.60	A1Vn	9	05	01.0	4.065	-32	+47	04	48.45	14.53	-54
345	3634	λ Velorum	2.21	K4 Ib-II	9	08	45.1	2.211	-17	-43	30	58.06	-14.69	+13
1239	3627	ξ Cancri	5.14	G9 III	9	10	32.1	3.438	+1	+21	57	40.80	14.80	+5
348	3685	β Carinae	1.68	A2IV	9	13	25.0	0.631	-311	-69	48	06.63	14.87	+108
347	3665	θ Hydrae	3.88	B9.5 V	9	15	25.8	3.118	+86	+2	13	36.09	15.40	-310
351	3699	ι Carinae	2.25	A8 Ib	9	17	38.3	1.605	-26	-59	21	42.56	15.21	+8
352	3705	α Lyncis	3.13	K7 III	9	22	17.9	3.636	-179	+34	18	16.91	15.46	+19
1243	3718	θ Pyxidis	4.72	M0 III	9	22	24.1	2.660	-8	-26	03	12.81	-15.49	-8
353	3734	κ Velorum*	2.50	B2 IV-V	9	22	45.0	1.861	-10	-55	05	55.95	15.50	+9
354	3748	α Hydrae*	1.98	K3 II-III	9	28	35.7	2.948	-9	-8	44	54.34	15.79	+33
361	3803	N Velorum	3.13	K5 III	9	31	50.8	1.826	-39	-57	07	31.40	15.99	+4
355	3757	23 Ursae Maj.	3.67	F0 IV	9	33	07.4	4.657	+160	+62	58	14.78	16.04	+27
358	3775	θ Ursae Maj.	3.17	F7V	9	34	13.0	3.974	-1024	+51	34	57.72	-16.65	-530

* **No. 295 : *Pollux*, Punarvasu-1.**
No. 326 : Pusya.
No. 329 : Aslesa.

No. 337 : Acubens. (Aslesa.)
No. 353 : *Markeb* .
No. 354 : *Alphard* .

MEAN PLACES OF STARS, J 2020.5

FOR JULY 2^{d}.125 TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spectral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
1250	3845	ι Hydrae	3.91	K2.5 III	9	40	54.1	3.062	+32	-1	14	12.64	-16.53	-64
364	3849	κ Hydrae	5.06	B4IV/V	9	41	17.4	2.878	-19	-14	25	34.18	16.50	-20
365	3852	ο Leonis	3.52	F5I+	9	42	14.6	3.196	-96	+9	47	53.24	16.57	-37
367	3873	ε Leonis	2.98	G1 II	9	47	00.7	3.393	-34	+23	40	43.94	16.77	-11
368	3888	ν Ursae Maj.	3.80	F2 IV	9	52	25.8	4.210	-379	+58	56	28.20	17.17	-151
371	3905	μ Leonis	3.88	K2 III	9	53	55.5	3.399	-160	+25	54	34.07	17.14	-56
375	3940	φ Velorum	3.54	B5 Ib	9	57	35.1	2.115	-12	-54	39	57.40	-17.25	+3
1261	3970	ν´ Hydrae	4.60	B8 V	10	06	07.4	2.924	-25	-13	09	53.24	17.60	+18
379	3975	η Leonis	3.52	A0 Ib	10	08	26.9	3.262	-1	+16	39	42.85	17.71	0
380	3982	α Leonis*	1.35	B7 V	10	09	27.7	3.189	-169	+11	51	58.48	17.75	+7
381	3994	λ Hydrae	3.61	K0IIICN+1	10	11	35.3	2.927	-138	-12	27	21.87	17.93	-88
385	4037	ω Carinae	3.32	B8 IIIe	10	14	13.3	1.420	-76	-70	08	24.11	17.94	+7
382	4023	191 G.Velorum	3.85	A2 Va	10	15	36.0	2.529	-131	-42	13	27.04	-17.95	+45
1264	4050	187 G. Carinae	3.40	K3 II a	10	17	46.2	2.013	-34	-61	26	51.85	18.08	+5
384	4031	ζ Leonis	3.44	F0 III	10	17	49.6	3.325	+13	+23	18	06.68	18.09	-7
383	4033	λ Ursae Maj.	3.45	A2 IV	10	18	19.5	3.592	-149	+42	48	40.42	18.14	-38
1268	4080	204 G.Velorum	4.83	K1 III	10	23	12.6	2.585	-20	-41	45	13.51	18.22	+56
386	4069	μ Ursae Maj.	3.05	M0 III	10	23	32.6	3.549	-72	+41	23	44.40	18.26	+35
391	4102	I Carinae	4.00	F3 V	10	24	47.8	1.173	-52	-74	08	10.12	-18.36	-26
389	4094	μ Hydrae	3.81	K4III	10	27	05.0	2.906	-89	-16	56	29.69	18.50	-80
392	4104	α Antliae	4.25	K4 III	10	28	05.6	2.754	-58	-31	10	21.83	18.44	+11
393	4114	196 G. Carinae	3.82	F2II	10	28	38.1	2.216	-17	-58	50	40.49	18.47	0
1270	4116	δ Sextantis	5.21	B9.5 V	10	30	31.2	3.047	-32	-2	50	40.71	18.55	-14
397	4140	203 G. Carinae	3.32	B4 Vne	10	32	45.4	2.147	-27	-61	47	28.35	18.60	+9
396	4133	ρ Leonis	3.85	B1 Iab	10	33	53.3	3.154	-4	+9	12	01.76	-18.65	-3
401	4174	γ Chamaeleontis	4.11	M0 III	10	35	41.6	0.653	-143	-78	42	50.99	18.69	+14
406	4199	θ Carinae	2.76	B0Vp	10	43	41.5	2.156	-35	-64	30	07.96	18.93	+10
411	4234	δ´ Chamaeleontis	4.45	B2.5 IV	10	45	56.9	0.479	-201	-80	38	54.05	19.00	+8
410	4232	ν Hydrae	3.11	K0/K1III	10	50	38.3	2.965	+66	-16	18	05.08	18.93	+200
412	4247	46 Leonis Min.	3.83	K0IIIV	10	54	27.2	3.338	+70	+34	06	13.94	19.51	-279
1283	4287	α Crateris	4.08	K1III	11	00	46.5	2.929	-323	-18	24	29.97	-19.25	+130
416	4295	β Ursae Maj.*	2.37	A1V	11	03	03.9	3.577	+99	+56	16	19.37	19.39	+34
417	4301	α Ursae Maj.*	1.80	K0 Iab	11	04	58.6	3.647	-167	+61	38	23.04	19.53	-66
1289	4337	260 G. Carinae	3.91	G0Iab	11	09	28.3	2.586	-9	-59	05	10.99	19.56	0
420	4335	ψ Ursae Maj.	3.01	K1 III	11	10	48.5	3.348	-60	+44	23	12.81	19.61	-28
422	4357	δ Leonis*	2.56	A4V	11	15	11.8	3.182	+101	+20	24	39.79	19.79	-130
423	4359	θ Leonis*	3.34	A2V	11	15	18.8	3.142	-42	+15	19	01.86	-19.74	-79
425	4377	ν Ursae Maj.	3.48	K3 III	11	19	34.9	3.225	-20	+32	58	55.70	19.70	+28
426	4382	δ Crateris	3.56	K0III	11	20	22.1	3.006	-84	-14	53	23.15	19.53	+208
433	4434	λ Draconis	3.84	M0 III	11	32	36.0	3.488	-73	+69	13	03.72	19.92	-17
434	4450	ξ Hydrae	3.54	G7 III	11	34	00.9	2.965	-162	-31	58	16.44	19.95	-39
436	4467	λ Centauri	3.13	B9III	11	36	44.2	2.802	-61	-63	08	00.08	-19.94	-5

* **No. 380 : *Regulus* , Magha.**
No. 416 : *Merak* , Pulaha.
No. 417 : *Dubhe* , Kratu.
No. 422 : *Zosma* , Purva Phalguni-1.
No. 423 : Purva Phalguni-2.

MEAN PLACES OF STARS, J 2020.5

FOR JULY $2^{d}.125$ TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec- tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
442	4520	λ Muscae	3.64	A7 V	11	46	35.2	2.875	-174	-66	50	32.82	-19.97	+37
441	4518	χ Ursae Maj.	3.71	K0.5 IIIb	11	47	07.5	3.144	-136	+47	39	56.34	19.98	+30
1304	4527	93 Leonis*	4.53v	A7V+	11	49	02.5	3.088	-106	+20	06	17.70	20.02	-3
444	4534	β Leonis*	2.14	A3 V	11	50	06.2	3.056	-342	+14	27	26.57	20.14	-114
445	4540	β Virginis	3.61	F9 V	11	51	45.8	3.126	+495	+1	38	56.74	20.30	-271
447	4554	γ Ursae Maj.*	2.44	A0 Ve	11	54	54.0	3.126	+107	+53	34	50.63	20.02	+12
452	4621	δ Centauri	2.60	B2 IV ne	12	09	25.8	3.139	-36	-50	50	11.47	-20.03	-8
453	4630	ε Corvi	3.00	K2III	12	11	11.0	3.098	-51	-22	44	01.29	20.00	+13
455	4656	δ Crucis	2.80	B2 IV	12	16	14.7	3.227	-53	-58	51	46.16	20.00	-9
456	4660	δ Ursae Maj.*	3.31	A3 V	12	16	25.9	2.941	+127	+56	55	07.74	19.98	+9
457	4662	γ Corvi*	2.59	B8III	12	16	51.8	3.095	-112	-17	39	20.31	19.96	+23
459	4674	β Chamaeleontis	4.26	B5 Vn	12	19	35.5	3.669	-174	-79	25	33.03	19.95	+17
460	4689	η Virginis	3.89	A2 IV+	12	20	57.3	3.070	-42	-0	32	50.12	-19.98	-18
462	4730	α Crucis*A	1.33	B0.5 IV	12	27	45.2	3.390	-53	-63	12	44.81	19.91	-12
465	4757	δ Corvi*	2.95	A0IV(m)kB9	12	30	55.7	3.114	-146	-16	37	45.66	20.00	-138
468	4763	γ Crucis	1.63v	M3.5 III	12	32	18.9	3.370	+29	-57	13	39.81	20.10	-262
469	4773	γ Muscae	3.87	B5V	12	33	43.0	3.674	-126	-72	14	45.28	19.83	-2
472	4787	κ Draconis	3.87v	B6IIIp	12	34	20.8	2.526	-112	+69	40	31.49	19.80	+12
471	4786	β Corvi	2.65	G5 II	12	35	28.1	3.165	+2	-23	30	35.52	-19.86	-54
474	4798	α Muscae	2.69	B2 IV-V	12	38	25.6	3.655	-90	-69	14	53.51	19.77	-13
475	4813	χ Virginis	4.66	K2 III	12	40	18.4	3.104	-51	-8	06	29.43	19.76	-25
1326	4828	ρ Virginis	4.88	A0 V	12	42	55.3	3.037	+57	+10	07	22.43	19.78	-90
481	4853	β Crucis	1.25	B0.5 IV	12	48	56.0	3.555	-63	-59	48	01.50	19.60	-14
483	4905	ε Ursae Maj.*	1.77	A0p	12	54	55.5	2.621	+132	+55	50	56.04	19.47	-6
484	4910	δ Virginis*	3.38	M3III	12	56	38.2	3.025	-313	+3	17	11.03	-19.49	-54
485	4915	α CVn sq*	2.90	A0spe	12	56	59.0	2.797	-198	+38	12	28.93	19.37	+56
488	4932	ε Virginis*	2.83	G8 III	13	03	11.8	2.987	-185	+10	50	57.70	19.26	+20
487	4923	δ Muscae	3.62	K2 III	13	03	42.7	4.236	+543	-71	39	31.75	19.29	-20
492	4983	β Com	4.26	G0 V	13	12	49.7	2.795	-604	+27	46	28.91	18.16	+881
495	5020	γ Hydrae	3.00	G8 III	13	20	02.4	3.277	+47	-23	16	44.98	18.88	-45
496	5028	ι Centauri	2.75	kA15hA3nA3va	13	21	45.4	3.396	-284	-36	49	11.43	-18.87	-86
497	5054	ζ Ursae Maj.*pr	2.27	A2V	13	24	44.9	2.404	+141	+54	49	07.61	18.71	-20
498	5056	α Virginis*	0.98	B1 III-IV+	13	26	16.6	3.170	-28	-11	16	03.74	18.67	-28
501	5107	ζ Virginis	3.37	A3V	13	35	44.1	3.052	-190	-0	28	00.44	18.28	+42
504	5132	ε Centauri	2.30	B1 III	13	41	12.0	3.846	-32	-53	34	11.29	18.14	-17
509	5191	η Ursae Maj.*	1.86	B3 V	13	48	20.8	2.358	-125	+49	12	41.59	17.85	-11
508	5193	μ Centauri	3.04	B2Vmpe	13	50	51.6	3.644	-21	-42	34	30.18	-17.76	-20
513	5235	η Bootis	2.68	G0 IV	13	55	39.6	2.857	-44	+18	17	44.31	17.90	-358
512	5231	ζ Centauri	2.55	B2.5 IV	13	56	49.7	3.778	-56	-47	23	18.18	-17.54	-42

* **No. 1304 : Uttara Phalguni-2.**
No. 444 : *Denebola,* Uttara Phalguni-1.
No. 447 : *Phecda or Phad,* Pulastya.
No. 456 : *Megrez,* Atri.
No. 457 : *Minkar.*
No. 462 : *Acrux* .
No. 465 : *Algorel* , Hasta.

No. 483 : *Alioth,* Angira.
No. 484 : Minelauva.
No. 485 : 12 Canum Venaticorum, Mag. *p* 2.9
No. 488 : *Vindemiatrix.*
No. 497 : *Mizar* , Vasista. Mag. *f* . 4.0.
No. 498 : *Spica* , Citra.
No. 509 : *Alkaid, Benetnasch,* Marichi.

MEAN PLACES OF STARS, J 2020.5

FOR JULY 2^{d}.125 TERRESTRIAL TIME

(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec- tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
521	5291	α Draconis*	3.65	A0 III	14	04	56.7	1.629	-84	+64	16	14.85	-17.12	+18
518	5267	β Centauri*	0.61	B1 III	14	05	17.3	4.297	-43	-60	28	41.86	17.14	-19
519	5287	π Hydrae	3.27	K1III-IV	14	07	32.7	3.435	+33	-26	46	48.79	17.16	-139
520	5288	θ Centauri	2.06	K0 III	14	07	53.8	3.555	-429	-36	28	11.78	17.52	-520
523	5315	κ Virginis	4.19	K2.5 III	14	13	59.5	3.211	+5	-10	22	05.73	16.57	+140
526	5340	α Bootis*	-0.04	K1.5 III	14	16	35.8	2.739	-769	+19	04	35.24	18.59	-2000
525	5338	ι Virginis	4.08	F7IV	14	17	05.6	3.155	-2	-6	05	50.96	-16.99	-432
1371	5359	λ Virginis	4.52	A1V	14	20	13.4	3.258	-11	-13	27	52.28	16.38	+30
531	5404	θ Bootis	4.05	F7 V	14	25	53.7	2.042	-253	+51	45	23.86	16.51	-398
534	5429	ρ Bootis	3.58	K3 III	14	32	42.8	2.585	-77	+30	16	56.10	15.64	+119
535	5435	γ Bootis	3.03	A7 III	14	32	54.2	2.415	-97	+38	13	09.65	15.59	+153
537	5440	η Centauri	2.31	B1.5 IVne	14	36	49.1	3.839	-31	-42	14	48.22	15.56	-35
538	5460	α Centauri* cg	0.00	G +	14	41	00.3	4.128	-4998	-60	55	07.57	-14.60	+692
541	5469	α Lupi	2.30	B1.5 III	14	43	18.2	4.026	-21	-47	28	29.59	15.18	-18
545	5487	μ Virginis	3.88	F2 V	14	44	08.6	3.171	+73	-5	44	46.59	15.43	-316
539	5463	α Circini	3.19	A 7VpSrCrEu	14	44	11.3	4.932	-302	-65	03	46.12	15.35	-232
544	5485	371 G.Cen	4.05	K5 III	14	44	55.1	3.693	-52	-35	15	38.81	15.25	-180
547	5511	109 Virginis	3.72	A0 V	14	47	17.2	3.040	-76	+1	48	26.81	14.96	-27
542	5470	α Apodis	3.83	K2.5 III	14	50	30.2	7.783	-41	-79	07	45.38	-14.76	-16
550	5563	β Ursae Min.*	2.08	K4 III	14	50	40.0	-0.105	-76	+74	04	17.94	14.72	+12
548	5531	α´Librae*	2.75	A2HA5MA4IV	14	52	01.0	3.331	-73	-16	07	32.95	14.72	-67
552	5571	β Lupi	2.68	B2 III	14	59	53.0	3.959	-32	-43	12	54.73	14.22	-39
553	5576	κ Centauri	3.13	B2 IV	15	00	30.2	3.932	-17	-42	11	06.61	14.16	-24
555	5602	β Bootis	3.50	G8 IIIa	15	02	43.1	2.261	-36	+40	18	37.97	14.03	-28
556	5603	σ Librae	3.29	M3/M4III	15	05	16.5	3.528	-54	-25	21	40.55	-13.88	-43
559	5652	ι Librae*	4.54	B9IV pSc	15	13	23.6	3.434	-25	-19	52	04.90	13.36	-39
558	5649	ζ Lupi	3.41	G7 III	15	13	46.2	4.351	-122	-52	10	32.43	13.37	-73
563	5681	δ Bootis	3.47	G8 III	15	16	19.8	2.421	+69	+33	14	21.34	13.24	-112
564	5685	β Librae*	2.61	B8 IV	15	18	06.8	3.238	-65	-9	27	26.37	13.03	-19
560	5671	γ Tr. Austrini	2.89	A1 IV	15	20	51.2	5.703	-132	-68	45	11.28	12.86	-31
569	5735	γ Ursae Min.	3.05	A 3 Iab	15	20	42.7	-0.043	-40	+71	45	39.79	-12.81	+20
1402	5695	δ Lupi	3.22	B1.5 IV	15	22	43.5	3.964	-13	-40	43	13.20	12.73	-26
566	5705	φ' Lupi	3.56	K5 III	15	23	06.8	3.829	-74	-36	20	03.47	12.76	-84
571	5744	ι Draconis	3.29	K2 III	15	25	23.3	1.345	-12	+58	53	41.24	12.50	+17
572	5747	β Cr. Borealis	3.68	F0p	15	28	40.5	2.476	-137	+29	02	09.76	12.21	+86
578	5793	α Cr.Borealis*	2.23	A0 V	15	35	33.4	2.543	+91	+26	38	48.35	11.90	-88
577	5787	γ Librae	3.91	K0III	15	36	40.6	3.367	+45	-14	51	23.57	-11.72	+9
579	5794	ν Librae	3.58	K5 III	15	38	16.4	3.658	-7	-28	12	05.20	11.62	+3
1413	5838	κ Librae	4.74	K5III	15	43	07.9	3.469	-26	-19	44	37.91	11.37	-103
582	5854	α Serpentis*	2.65	K2 III b	15	45	16.8	2.961	+92	+6	21	44.67	-11.07	+47

* **No. 518 : *Agena* .**
No. 521 : *Thuban* .
No. 526 : *Arcturus* , Svati.
No. 538 : Rigil *Kentaurus* Mag. 0.33 & 1.70.
No. 548 : *Zuben el Genubi*, Visakha.
No. 550 : *Kochab* .
No. 559 : Visakha.
No. 564 : *Zuben es Chamali.*
No. 578 : *Margarita, Alphecca.*
No. 582 : *Unukalhaly.*

MEAN PLACES OF STARS, J 2020.5

FOR JULY 2^{d}.125 TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec-tral Type	Right Ascension h	m	s	Annual Variation s	Annual Proper motion s (0.0001)	Declination °	'	"	Annual Variation "	Annual Proper motion " (0.001)
583	5867	β Serpentis	3.67	A3V	15	47	08.1	2.773	+46	+15	21	31.86	-11.02	-45
585	5881	μ Serpentis	3.54	A0 V	15	50	41.5	3.138	-57	-3	29	29.82	10.74	-24
588	5892	ε Serpentis	3.71	A2 m	15	51	50.4	2.996	+86	+4	25	02.38	10.57	+63
589	5897	β Tr.Australis	2.85	F1V	15	56	58.0	5.349	-283	-63	29	30.06	10.65	-398
591	5933	γ Serpentis	3.85	F6 V	15	57	24.1	2.776	+217	+15	35	45.43	11.50	-1281
592	5944	π Scorpii	2.89	B1 V+	16	00	05.8	3.643	-8	-26	10	17.52	10.04	-26
594	5953	δ Scorpii*	2.32	B0.2 Ive	16	01	33.0	3.560	-8	-22	40	42.46	-9.93	-22
597	5984	β Scorpii*pr	2.62	B0.5 V	16	06	37.9	3.500	-4	-19	51	35.88	9.53	-19
603	6056	δ Ophiuchi	2.74	M0.5 III	16	15	25.3	3.151	-29	-3	44	44.39	8.97	-143
605	6075	ε Ophiuchi	3.24	G9.5 IIIb	16	19	24.5	3.181	+57	-4	44	27.63	8.48	+41
608	6092	τ Herculis	3.89	B5 IV	16	20	21.5	1.808	-11	+46	15	55.47	8.40	+40
607	6084	σ Scorpii	2.89	B1 III	16	22	26.3	3.659	-8	-25	38	25.28	8.30	-21
609	6095	γ Herculis	3.75	B9 III	16	22	49.5	2.650	-33	+19	06	22.31	-8.20	+43
613	6117	ω Herculis	4.57	B9 p	16	26	21.8	2.773	+30	+13	59	14.52	8.02	-59
616	6134	α Scorpii* cg	0.96	M1.5 Iab-b	16	30	40.1	3.690	-7	-26	28	32.74	7.64	-20
618	6148	β Herculis	2.77	G7 III a	16	31	06.1	2.582	-70	+21	26	46.12	7.60	-15
611	6102	γ Apodis	3.89	G8III	16	36	39.5	9.418	-452	-78	56	20.05	7.21	-77
620	6165	τ Scorpii	2.82	B0.2 V	16	37	09.7	3.746	-6	-28	15	24.54	7.11	-22
622	6175	ζ Ophiuchi	2.56	O9V	16	38	17.4	3.311	+9	-10	36	25.37	-6.97	+26
626	6220	η Herculis	3.53	G7 .5IIIb	16	43	36.0	2.060	+32	+38	53	03.57	6.64	-82
625	6217	α Tr. Austr.*	1.92	K2 II-III	16	50	51.2	6.412	+26	-69	03	44.48	5.99	-34
1438	6243	20 Ophiuchi	4.65	F7 V	16	50	58.2	3.326	+65	-10	49	32.11	6.04	-93
628	6241	ε Scorpii	2.29	K1 III	16	51	29.7	3.898	-493	-34	19	03.67	6.16	-257
1435	6229	η Arae	3.76	K5 III	16	51	33.9	5.212	+49	-59	04	43.10	5.92	-28
1439	6247	μ' Scorpii	3.08v	B1.5Vp+	16	53	15.8	4.077	-9	-38	04	50.40	-5.78	-25
633	6299	κ Ophiuchi	3.20	K2 III	16	58	38.4	2.844	-197	+9	20	40.34	5.31	-11
631	6285	ζ Arae	3.13	K3III	17	00	19.4	4.989	-23	-56	01	12.51	5.20	-36
634	6324	ε Herculis	3.92	A0 V	17	01	04.5	2.298	-36	+30	53	50.51	5.07	+27
635	6355	60 Herculis	4.91	A4 IV	17	06	19.8	2.786	+35	+12	42	50.65	4.66	-10
639	6396	ζ Draconis	3.17	B6 III	17	08	51.0	0.188	-33	+65	41	22.24	4.41	+22
638	6380	η Scorpii	3.33	F5IV	17	13	37.5	4.309	+23	-43	15	50.73	-4.31	-287
643	6418	π Herculis	3.16	K3 Ib	17	15	45.7	2.093	-22	+36	47	58.59	3.84	+4
641	6410	δ Herculis	3.14	A3IV	17	15	52.5	2.467	-15	+24	48	13.64	3.99	-157
644	6453	θ Ophiuchi	3.27	B2 IV	17	23	16.2	3.691	-3	-25	01	05.34	3.22	-20
645	6461	β Arae	2.85	K3 Ib-II	17	27	00.5	5.002	-10	-55	32	48.59	2.90	-25
1457	6486	44 Ophiuchi	4.17	kA5hA9mF1III	17	27	37.4	3.670	0	-24	11	32.48	2.94	-116
653	6536	β Draconis	2.79	G2Iab	17	30	53.8	1.360	-17	+52	17	12.98	-2.52	+15
649	6508	ν Scorpii	2.69	B2 IV	17	32	09.6	4.086	-1	-37	18	36.69	2.46	-31
648	6500	δ Arae	3.62	B8 Vn	17	32	57.2	5.432	-80	-60	41	53.69	2.46	-96
651	6510	α Arae	2.95	B2 Vne	17	33	25.8	4.648	-32	-49	53	24.67	2.39	-70
652	6527	λ Scorpii*	1.63	B2 IV+	17	35	00.2	4.080	-1	-37	07	00.29	2.21	-29
656	6556	α Ophiuchi*	2.08	A5 III	17	35	53.2	2.788	+83	+12	32	47.50	-2.33	-226

* **No. 594 : *Dschubba*, Anuradha**
No. 597 : *Graffias*, Mag. 2.9, 5.1
No. 616 : *Antares* , Jyestha, Mag. 0.9 to 1.8.
No. 625 : *Atria*.
No. 652 : *Schaula* , Mula.
No. 656 : *Ras Alhague*.

MEAN PLACES OF STARS, J 2020.5

FOR JULY 2^{d}.125 TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spectral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
658	6561	ξ Serpentis	3.54	A9IIIpSr	17	38	45.7	3.439	-29	-15	24	31.53	-1.91	-58
654	6553	θ Scorpii	1.87	F1 II	17	38	47.6	4.318	+14	-43	00	35.04	1.85	-2
663	6588	ι Herculis	3.80	B3 IV	17	40	02.7	1.697	-5	+45	59	46.76	1.74	+5
660	6580	κ Scorpii	2.41	B1.5 III	17	43	54.5	4.156	-5	-39	02	18.73	1.43	-27
665	6603	β Ophiuchi	2.77	K2 III	17	44	29.2	2.966	-27	+4	33	36.83	1.20	+159
667	6623	μ Herculis	3.42	G5IV	17	47	15.7	2.351	-233	+27	42	50.64	1.87	-752
661	6582	η Pavonis	3.62	K2II	17	47	44.9	5.900	-21	-64	43	35.40	-1.13	-54
668	6629	γ Ophiuchi	3.75	A0 V	17	48	55.3	3.011	-15	+2	42	58.49	1.04	-74
666	6615	ι¹ Scorpii	3.03	F2 I ae	17	49	01.2	4.200	-0	-40	07	03.90	0.97	-8
669	6630	*G* Scorpii	3.21	K2 III	17	51	15.3	4.087	+41	-37	02	52.10	0.73	+33
671	6688	ξ Draconis	3.75	K2 III	17	53	53.0	1.040	+114	+56	52	11.92	0.45	+80
672	6695	θ Herculis	3.86	K1 IIaCn+	17	56	57.4	2.060	+4	+37	14	55.95	0.26	+6
676	6705	γ Draconis*	2.23	K5 III	17	57	05.0	1.396	-8	+51	29	14.16	-0.27	-19
674	6703	ξ Herculis	3.70	G8 III	17	58	33.7	2.334	+64	+29	14	48.82	0.14	-17
673	6698	ν Ophiuchi	3.34	G 9 III	18	00	09.3	3.305	-4	-9	46	28.21	-0.10	-116
677	6714	67 Ophiuchi	3.97	B5 Ib	18	01	40.4	3.007	+1	+2	55	55.51	+0.14	-8
679	6746	γ Sagittarii	2.99	K1III	18	07	07.5	3.855	-41	-30	25	18.90	0.44	-185
1471	6743	θ Arae	3.66	B2 Ib	18	08	13.6	4.671	-10	-50	05	16.54	0.71	-14
680	6771	72 Ophiuchi	3.73	A4IVs	18	08	19.3	2.846	-41	+9	34	05.55	+0.81	+80
681	6779	ο Herculis	3.83	B9.5V	18	08	20.6	2.342	+1	+28	45	59.44	0.74	+10
682	6812	μ Sagittarii	3.86	B2III	18	14	59.4	3.589	+1	-21	03	06.01	1.31	+1
683	6832	η Sagittarii	3.11	M3.5 III	18	19	00.9	4.059	-106	-36	45	12.77	1.49	-167
695	6927	χ Draconis	3.57	F7 V	18	20	41.1	-1.088	+1200	+72	44	03.15	1.46	-346
687	6859	δ Sagittarii*	2.70	K3IIIa	18	22	18.4	3.840	+27	-29	49	28.56	1.92	-28
688	6869	η Serpentis	3.26	K0 III-IV	18	22	22.3	3.106	-364	-2	53	31.01	+1.25	-701
690	6895	109 Herculis	3.84	K2 III	18	24	34.3	2.559	+141	+21	46	49.31	1.90	-242
689	6879	ε Sagittarii*	1.85	B9.5III	18	25	31.9	3.981	-31	-34	22	22.81	2.10	-124
691	6897	α Telescopii	3.51	B3 IV	18	28	29.5	4.445	-15	-45	57	17.93	2.43	-54
692	6913	λ Sagittarii	2.81	K0IV	18	29	14.1	3.702	-32	-25	24	30.80	2.36	-185
697	6951	θ Coronae Aust.	4.64	G8 III	18	34	57.9	4.280	+28	-42	17	44.40	3.02	-22
1482	6973	α Scuti	3.85	K3 III	18	36	19.4	3.265	-10	-8	13	41.17	+2.85	-312
699	7001	α Lyrae*	0.03	A0 V	18	37	38.0	2.033	+172	+38	48	13.59	3.56	+287
1487	7039	φ Sagittarii	3.17	B8 III	18	46	56.2	3.745	+40	-26	58	04.38	4.08	+1
1489	7063	β Scuti	4.22	G4 IIa	18	48	15.7	3.183	-3	-4	43	27.77	4.17	-16
705	7106	β Lyrae*	3.45	B7 Ve+	18	50	50.2	2.217	+3	+33	23	15.32	4.41	-3
706	7121	σ Sagittarii*	2.02	B2V	18	56	32.1	3.716	+10	-26	16	10.12	4.84	-54
710	7150	ξ² Sagittarii	3.51	G9II/III	18	58	57.1	3.576	+24	-21	04	40.74	+5.09	-12
713	7178	γ Lyrae	3.24	B9 III	18	59	42.7	2.246	-2	+32	43	07.64	5.16	+2
712	7176	ε Aquilae	4.02	K1 III	19	00	33.2	2.724	-35	+15	05	50.79	5.16	-74
716	7235	ζ Aquilae	2.99	A0 Vn	19	06	21.2	2.758	-3	+13	53	42.95	5.63	-96
717	7236	λ Aquilae	3.44	B9Vn	19	07	20.2	3.183	-11	-4	51	00.93	5.71	-90
1496	7234	τ Sagittarii	3.32	K1III	19	08	13.1	3.740	-40	-27	38	19.30	+5.63	-251

No. 676 : ***Eltanin.***
No. 687 : Purvasadha-1.
No. 689 : ***Kaus Australis*** **, Purvasadha-2.**
No. 699 : ***Vega*** **, Abhijit.**
No. 705 : Sheliak Mag. 3.3 to 4.3.
No. 706 : ***Nunki*** **, Uttarasadha.**

MEAN PLACES OF STARS, J 2020.5

FOR JULY $2^d.125$ TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spectral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
720	7264	π Sagittarii	2.89	F2 II/III	19	10	58.9	3.564	0	-20	59	21.60	+6.07	-35
723	7310	δ Draconis	3.07	G9 III	19	12	33.3	-0.004	+164	+67	41	51.38	6.33	+93
726	7328	κ Cygni	3.77	G9 III	19	17	34.5	1.384	+66	+53	24	25.13	6.78	+125
730	7377	δ Aquilae	3.36	F0IV	19	26	31.9	3.024	+171	+3	09	25.47	7.47	+83
1508	7405	α Vulpeculae	4.44	M0III	19	29	33.5	2.498	-92	+24	42	27.28	7.53	-106
733	7420	ι Cygni	3.79	A5V	19	30	13.3	1.511	+22	+51	46	27.09	7.82	+130
732	7417	β Cygni∗*p*	3.08	K3II+	19	31	32.9	2.421	+2	+28	00	13.90	+7.79	-2
1513	7488	β Sagittae	4.37	G8III a	19	41	58.2	2.695	+7	+17	31	29.18	8.59	-32
741	7525	γ Aquilae	2.72	K3 II	19	47	14.1	2.852	+12	+10	39	52.26	9.04	-2
743	7536	δ Sagittae	3.82	M2 II+	19	48	18.1	2.676	+5	+18	35	09.79	9.13	+8
745	7557	α Aquilae∗	0.77	A7 V	19	51	47.0	2.926	+362	+8	55	25.71	9.78	+387
746	7570	η Aquilae	3.90V.	F6Iab	19	53	31.0	3.054	+7	+1	03	34.69	9.52	-7
749	7602	β Aquilae∗	3.71	G9.5IV	19	56	19.2	2.946	+33	+6	27	33.32	+9.26	-482
752	7635	γ Sagittae	3.47	M0 III	19	59	40.1	2.669	+46	+19	32	56.49	10.02	+24
751	7623	θ^1 Sagittarii	4.37	B3 IV	20	01	04.0	3.890	+5	-35	13	09.22	10.08	-26
754	7665	δ Pavonis	3.56	G8 IV	20	10	43.0	5.816	+1997	-66	07	38.25	9.70	-1126
756	7710	θ Aquilae	3.23	B9.5 III+	20	12	21.0	3.061	+26	-0	52	33.69	10.95	+4
757	7735	31 o^2 Cygni	3.79	K2II+	20	14	16.7	1.890	+4	+46	48	15.63	11.08	+3
761	7754	α^2 Capricorni∗	3.57	G8.5III-IV	20	19	11.4	3.323	+44	-12	28	47.72	+11.44	+4
762	7776	β Capricorni	3.08	K0:II:+	20	22	09.7	3.364	+29	-14	42	54.97	11.65	+2
765	7796	γ Cygni	2.20	F8 I ab	20	22	57.9	2.155	+4	+40	19	23.61	11.71	0
764	7790	α Pavonis	1.94	B2IV	20	27	15.4	4.703	+9	-56	40	03.16	11.92	-89
768	7852	ε Delphini	4.03	B6 III	20	34	11.5	2.866	+9	+11	22	26.72	12.47	-22
(771)	7882	β Delphini∗m	3.64	F5 IV	20	38	30.6	2.814	+81	+14	40	02.72	12.73	-48
769	7869	α Indi	3.11	K0 III-IV	20	39	00.0	4.191	+52	-47	13	06.33	+12.88	+66
774	7906	α Delphini∗	3.77	B9 IV	20	40	35.4	2.787	+46	+15	59	07.50	12.92	-2
777	7924	α Cygni∗	1.25	A2 Iae	20	42	07.9	2.047	+3	+45	21	15.90	13.03	+2
778	7928	δ Delphini	4.43	A7IIIp	20	44	25.0	2.801	-13	+15	08	57.00	13.13	-43
783	7957	η Cephei	3.43	K0 IV	20	45	42.2	1.210	+120	+61	55	39.13	14.08	+819
775	7913	β Pavonis	3.42	A7III	20	46	46.8	5.322	-76	-66	07	08.00	13.34	+11
780	7949	ε Cygni	2.46	K0 III	20	47	02.5	2.430	+286	+34	02	52.74	+13.68	+329
1541	7948	γ Delphini sq	4.27	K1 IV	20	47	36.6	2.784	-22	+16	11	57.16	13.19	-197
781	7950	ε Aquarii	3.77	A1.5V	20	48	47.0	3.242	+24	-9	25	10.21	13.43	-34
1547	7990	μ Aquarii	4.73	A3m	20	53	45.5	3.230	+30	-8	54	18.76	13.75	-30
785	7986	β Indi	3.65	K1 II	20	56	23.8	4.636	+21	-58	22	30.64	13.92	-26
1550	8039	γ Microscopii	4.67	G6III	21	02	32.6	3.663	-2	-32	10	34.87	14.33	+5
792	8079	ξ Cygni	3.72	K4.5 Ib-II	21	05	40.7	2.186	+8	+44	00	37.47	+14.52	+1
797	8115	ζ Cygni	3.20	G8III	21	13	48.6	2.557	+1	+30	18	42.89	14.94	-56
800	8131	α Equulei	3.92	G0III+	21	16	50.9	2.998	+39	+5	20	00.93	15.09	-88
803	8162	α Cephei∗	2.44	A7IV	21	19	04.0	1.427	+219	+62	40	22.48	15.35	+50
806	8204	ζ Capricorni	3.74	G4 Ibp	21	27	50.0	3.413	+1	-22	19	17.39	+15.81	+23

∗ **No. 732 : *Albireo* ., Mag. *f* . 5.4.**
No. 745 : *Altair* , Sravana.
No. 749 : *Alshain* .
No. 761 : Giedi or Algedi.

No. 771 : *Rotanev* , Dhanistha-1.
No. 774 : *Saulocin*, Dhanistha-2.
No. 777 : *Deneb*.
No. 803 : *Alderamin*.

MEAN PLACES OF STARS, J 2020.5

FOR JULY $2^{d}.125$ TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spectral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
809	8238	β Cephei	3.23	B2 IIIev	21	28	55.0	0.747	+21	+70	39	03.39	+15.85	+7
808	8232	β Aquarii*	2.91	G0 Ib	21	32	38.2	3.154	+14	-5	28	48.18	16.03	-8
1569	8264	ξ Aquarii	4.69	A7 V	21	38	50.5	3.188	+78	-7	45	40.92	16.33	-25
812	8278	γ Capricorni	3.68	A7 mp	21	41	13.4	3.315	+132	-16	34	07.64	16.45	-23
810	8254	ν Octantis	3.76	K1 III	21	43	40.7	6.411	+140	-77	17	49.91	16.36	-240
815	8308	ε Pegasi*	2.34	K2 Ib	21	45	11.6	2.947	+21	+9	58	11.22	16.67	-1
819	8322	δ Capricorni	2.87	kA5hF0mF2III	21	48	10.2	3.303	+183	-16	02	00.15	+16.52	-296
822	8353	γ Gruis	3.01	B8III	21	55	09.8	3.611	+86	-37	16	03.20	17.12	-21
827	8414	α Aquarii*	2.96	G2 Ib	22	06	50.0	3.072	+13	-0	24	10.33	17.64	-10
831	8430	ι Pegasi	3.76	F5 V	22	07	58.0	2.799	+220	+25	26	45.17	17.72	+25
829	8425	α Gruis*	1.74	B6V	22	09	30.9	3.749	+126	-46	51	39.18	17.61	-151
834	8450	θ Pegasi	3.53	A1Va	22	11	14.0	3.026	+185	+6	17	57.85	17.85	+27
836	8465	ζ Cephei	3.35	K1.5 Iab	22	11	34.1	2.091	+19	+58	18	10.02	+17.84	+4
841	8502	α Tucanae	2.86	K3 III	22	19	53.3	4.051	-96	-60	09	23.72	18.12	-43
842	8518	γ Aquarii	3.84	A0V	22	22	42.9	3.096	+88	-1	17	00.29	18.27	+7
846	8556	δ' Gruis	3.97	G7III	22	30	29.2	3.559	+26	-43	23	24.73	18.53	-5
848	8585	α Lacertae	3.77	A1 V	22	32	08.4	2.486	+144	+50	23	18.19	18.61	+19
849	8592	ν Aquarii	5.20	F7 V	22	35	48.7	3.272	+158	-20	36	09.42	18.56	-144
850	8597	η Aquarii	4.02	B9 IV-V:n	22	36	24.5	3.080	+61	-0	12	40.65	+18.67	-56
855	8634	ζ Pegasi	3.40	B8V	22	42	29.1	2.995	+55	+10	56	19.88	18.89	-12
856	8636	β Gruis	2.10	M5 III	22	43	53.0	3.552	+133	-46	46	36.80	18.94	-8
857	8650	η Pegasi	2.94	G2II-III+	22	43	58.0	2.822	+11	+30	19	44.18	18.92	-25
860	8675	ε Gruis	3.49	A2IVnSB2	22	49	47.0	3.588	+115	-51	12	30.80	19.04	-71
863	8694	ι Cephei	3.52	K0III	22	50	24.9	2.154	-108	+66	18	02.30	19.00	-125
861	8679	τ Aquarii	4.01	K5III	22	50	40.5	3.170	-8	-13	29	30.82	+19.09	-38
862	8684	μ Pegasi	3.48	G8 III	22	50	59.7	2.904	+108	+24	42	36.97	19.10	-42
864	8698	λ Aquarii*	3.74	M2 III	22	53	41.0	3.126	+8	-7	28	12.33	19.25	+37
866	8709	δ Aquarii	3.27	A3 V	22	55	44.2	3.177	-28	-15	42	40.92	19.23	-25
867	8728	α PsA*	1.16	A4 V	22	58	46.8	3.300	+255	-29	30	47.45	19.17	-164
869	8762	ο Andromedae	3.62	B6III pe+	23	02	52.1	2.776	+20	+42	26	11.33	19.42	-6
870	8775	β Pegasi*	2.42	M2.5 II-III	23	04	46.3	2.919	+143	+28	11	39.70	+19.60	+138
871	8781	α Pegasi*	2.49	B9III	23	05	47.0	2.994	+44	+15	18	57.24	19.44	-42
873	8812	88 Aquarii	3.66	K1III	23	10	32.2	3.189	+40	-21	03	38.87	19.61	+31
878	8852	γ Piscium	3.69	G9 III	23	18	13.7	3.112	+509	+3	23	40.42	19.73	+17
890	8961	λ Andromedae	3.82v	G8 III	23	38	34.5	2.959	+157	+46	34	09.78	19.53	-421
893	8974	γ Cephei	3.21	K1 IV	23	40	12.4	2.523	-212	+77	44	49.16	20.12	+151
902	9072	ω Piscium	4.01	F4V	0	00	22.0	3.086	+103	+6	58	36.33	+19.93	-115

BS = Bright Star Catalogue   HR = Havard Revised Catalogue   FK5 = Fifth Fundamental Catalogue

* **No. 808 :** ***Sadalsuud.***
No. 815 : ***Enif*** **. Mag. 0.7 to 3.5.**
No. 827 : ***Sadalmelik.***
No. 829 : ***Al Nair.***
No. 864 : Satabhisaj.
No. 867 : ***Fomalhaut*** **.**
No. 870 : ***Scheat*** **, Purva Bhadrapada-2.**
No. 871 : ***Markab*** **, Purva Bhadrapada-1.**

APPARENT PLACES OF STARS, 2020

FOR 0^h TERRESTRIAL TIME

Name		γ Pegasi						α Phoenicis						β Ceti						β Andromedae					
Mag. Spect.		2.83			B2 IV			2.39			K0 III			2.04			K0 III			2.06			M0 III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	0	14	15	+15	17	38	0	27	15	-42	12	11	0	44	35	-17	52	51	1	10	51	+35	43	38
	11	0	14	15	15	17	37	0	27	15	42	12	11	0	44	34	17	52	52	1	10	51	35	43	38
	21	0	14	15	15	17	36	0	27	15	42	12	11	0	44	34	17	52	52	1	10	50	35	43	37
	31	0	14	15	15	17	35	0	27	15	42	12	10	0	44	34	17	52	52	1	10	50	35	43	36
Feb.	10	0	14	15	15	17	34	0	27	14	42	12	08	0	44	34	17	52	52	1	10	50	35	43	35
	20	0	14	15	15	17	33	0	27	14	42	12	07	0	44	34	17	52	51	1	10	50	35	43	33
Mar.	1	0	14	14	+15	17	32	0	27	14	-42	12	05	0	44	34	-17	52	51	1	10	50	+35	43	31
	11	0	14	14	15	17	32	0	27	14	42	12	02	0	44	34	17	52	49	1	10	50	35	43	30
	21	0	14	14	15	17	31	0	27	14	42	12	01	0	44	34	17	52	48	1	10	50	35	43	28
	31	0	14	15	15	17	30	0	27	14	42	11	57	0	44	34	17	52	47	1	10	50	35	43	27
Apr.	10	0	14	15	15	17	30	0	27	14	42	11	54	0	44	34	17	52	45	1	10	50	35	43	25
	20	0	14	15	15	17	31	0	27	14	42	11	51	0	44	34	17	52	43	1	10	50	35	43	24
	30	0	14	15	+15	17	31	0	27	15	-42	11	48	0	44	34	-17	52	40	1	10	50	+35	43	23
May	10	0	14	15	15	17	32	0	27	15	42	11	45	0	44	35	17	52	38	1	10	50	35	43	23
	20	0	14	15	15	17	33	0	27	15	42	11	42	0	44	35	17	52	36	1	10	50	35	43	23
	30	0	14	16	15	17	34	0	27	16	42	11	39	0	44	35	17	52	33	1	10	51	35	43	23
June	9	0	14	16	15	17	36	0	27	16	42	11	36	0	44	35	17	52	31	1	10	51	35	43	24
	19	0	14	16	15	17	38	0	27	16	42	11	34	0	44	36	17	52	29	1	10	51	35	43	25
	29	0	14	17	+15	17	40	0	27	17	-42	11	32	0	44	36	-17	52	26	1	10	52	+35	43	26
July	9	0	14	17	15	17	42	0	27	17	42	11	31	0	44	36	17	52	24	1	10	52	35	43	28
	19	0	14	17	15	17	44	0	27	17	42	11	30	0	44	37	17	52	23	1	10	53	35	43	30
	29	0	14	18	15	17	46	0	27	18	42	11	30	0	44	37	17	52	22	1	10	53	35	43	32
Aug.	8	0	14	18	15	17	48	0	27	18	42	11	29	0	44	37	17	52	20	1	10	53	35	43	34
	18	0	14	18	15	17	51	0	27	18	42	11	30	0	44	37	17	52	20	1	10	54	35	43	37
	28	0	14	18	+15	17	52	0	27	19	-42	11	31	0	44	38	-17	52	19	1	10	54	+35	43	39
Sept.	7	0	14	18	15	17	54	0	27	19	42	11	32	0	44	38	17	52	20	1	10	54	35	43	41
	17	0	14	19	15	17	56	0	27	19	42	11	34	0	44	38	17	52	20	1	10	54	35	43	44
	27	0	14	19	15	17	57	0	27	19	42	11	36	0	44	38	17	52	20	1	10	54	35	43	46
Oct.	7	0	14	19	15	17	58	0	27	19	42	11	38	0	44	38	17	52	22	1	10	54	35	43	48
	17	0	14	19	15	17	59	0	27	19	42	11	40	0	44	38	17	52	23	1	10	54	35	43	50
	27	0	14	19	+15	17	60	0	27	19	-42	11	42	0	44	38	-17	52	24	1	10	55	+35	43	52
Nov.	6	0	14	19	15	17	60	0	27	19	42	11	45	0	44	38	17	52	25	1	10	55	35	43	54
	16	0	14	19	15	17	60	0	27	19	42	11	47	0	44	38	17	52	27	1	10	54	35	43	55
	26	0	14	18	15	18	00	0	27	19	42	11	48	0	44	38	17	52	28	1	10	54	35	43	56
Dec.	6	0	14	18	15	17	60	0	27	19	42	11	50	0	44	38	17	52	29	1	10	54	35	43	57
	16	0	14	18	15	17	59	0	27	18	42	11	51	0	44	38	17	52	30	1	10	54	35	43	58
	26	0	14	18	+15	17	59	0	27	18	-42	11	51	0	44	38	-17	52	31	1	10	54	+35	43	58
	36	0	14	18	+15	17	58	0	27	18	-42	11	51	0	44	38	-17	52	31	1	10	54	+35	43	58

APPARENT PLACES OF STARS, 2020

FOR 0^h TERRESTRIAL TIME

Name		ζ Ceti						ν Ceti						α Arietis						α Ceti					
Mag. Spect.		3.73			K0 III			4.00			F7III			2.00			K2 III			2.53			M1.5IIIa		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	1	52	26	-10	14	24	2	00	56	-20	59	08	2	08	18	+23	33	22	3	03	19	+4	09	55
	11	1	52	26	10	14	25	2	00	56	20	59	09	2	08	18	23	33	21	3	03	19	4	09	55
	21	1	52	26	10	14	25	2	00	56	20	59	10	2	08	18	23	33	21	3	03	19	4	09	54
	31	1	52	26	10	14	25	2	00	56	20	59	10	2	08	17	23	33	21	3	03	19	4	09	54
Feb.	10	1	52	26	10	14	25	2	00	56	20	59	10	2	08	17	23	33	20	3	03	19	4	09	53
	20	1	52	26	10	14	25	2	00	56	20	59	09	2	08	17	23	33	19	3	03	19	4	09	53
Mar.	1	1	52	26	-10	14	25	2	00	56	-20	59	09	2	08	17	+23	33	18	3	03	19	+4	09	53
	11	1	52	26	10	14	25	2	00	55	20	59	07	2	08	17	23	33	17	3	03	19	4	09	53
	21	1	52	25	10	14	24	2	00	55	20	59	06	2	08	17	23	33	16	3	03	18	4	09	53
	31	1	52	25	10	14	23	2	00	55	20	59	05	2	08	17	23	33	15	3	03	18	4	09	53
Apr.	10	1	52	25	10	14	21	2	00	55	20	59	03	2	08	17	23	33	15	3	03	18	4	09	53
	20	1	52	25	10	14	20	2	00	55	20	59	00	2	08	17	23	33	15	3	03	18	4	09	54
	30	1	52	26	-10	14	18	2	00	55	-20	58	58	2	08	17	+23	33	14	3	03	18	+4	09	55
May	10	1	52	26	10	14	16	2	00	56	20	58	56	2	08	17	23	33	14	3	03	18	4	09	56
	20	1	52	26	10	14	14	2	00	56	20	58	53	2	08	17	23	33	14	3	03	18	4	09	57
	30	1	52	26	10	14	12	2	00	56	20	58	50	2	08	17	23	33	15	3	03	19	4	09	59
June	9	1	52	26	10	14	09	2	00	56	20	58	48	2	08	18	23	33	16	3	03	19	4	09	60
	19	1	52	27	10	14	07	2	00	56	20	58	45	2	08	18	23	33	17	3	03	19	4	10	02
	29	1	52	27	-10	14	05	2	00	57	-20	58	43	2	08	18	+23	33	18	3	03	19	+4	10	03
July	9	1	52	27	10	14	03	2	00	57	20	58	40	2	08	19	23	33	20	3	03	20	4	10	05
	19	1	52	28	10	14	01	2	00	57	20	58	39	2	08	19	23	33	21	3	03	20	4	10	07
	29	1	52	28	10	14	01	2	00	58	20	58	37	2	08	19	23	33	23	3	03	20	4	10	09
Aug.	8	1	52	28	10	13	58	2	00	58	20	58	36	2	08	20	23	33	25	3	03	21	4	10	10
	18	1	52	28	10	13	56	2	00	58	20	58	35	2	08	20	23	33	27	3	03	21	4	10	12
	28	1	52	29	-10	13	56	2	00	59	-20	58	34	2	08	20	+23	33	29	3	03	21	+4	10	13
Sept.	7	1	52	29	10	13	55	2	00	59	20	58	34	2	08	20	23	33	30	3	03	21	4	10	14
	17	1	52	29	10	13	55	2	00	59	20	58	34	2	08	21	23	33	32	3	03	22	4	10	15
	27	1	52	29	10	13	55	2	00	59	20	58	35	2	08	21	23	33	34	3	03	22	4	10	15
Oct.	7	1	52	29	10	13	56	2	00	59	20	58	36	2	08	21	23	33	35	3	03	22	4	10	15
	17	1	52	30	10	13	56	2	00	60	20	58	38	2	08	21	23	33	36	3	03	22	4	10	16
	27	1	52	30	-10	13	57	2	00	60	-20	58	39	2	08	21	+23	33	37	3	03	22	+4	10	15
Nov.	6	1	52	30	10	13	58	2	00	60	20	58	41	2	08	21	23	33	38	3	03	23	4	10	15
	16	1	52	30	10	14	00	2	00	60	20	58	43	2	08	21	23	33	39	3	03	23	4	10	14
	26	1	52	30	10	14	01	2	00	60	20	58	44	2	08	21	23	33	40	3	03	23	4	10	14
Dec.	6	1	52	30	10	14	02	2	00	60	20	58	46	2	08	21	23	33	40	3	03	23	4	10	13
	16	1	52	30	10	14	03	2	00	60	20	58	47	2	08	21	23	33	40	3	03	23	4	10	13
	26	1	52	29	-10	14	04	2	00	59	-20	58	49	2	08	21	+23	33	40	3	03	23	+4	10	12
	36	1	52	29	-10	14	05	2	00	59	-20	58	49	2	08	21	+23	33	40	3	03	23	+4	10	11

APPARENT PLACES OF STARS, 2020

FOR 0^h TERRESTRIAL TIME

Name		η Tauri						α Tauri						β Eridani						γ Orionis					
Mag. Spect.		2.87			B7 III			0.85			K5 III			2.79			K4 III			1.64			B2 III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	3	48	41	+24	09	55	4	37	04	+16	32	50	5	08	50	-5	03	48	5	26	13	+6	21	55
	11	3	48	41	24	09	55	4	37	04	16	32	50	5	08	50	5	03	49	5	26	13	6	21	54
	21	3	48	40	24	09	55	4	37	04	16	32	50	5	08	50	5	03	50	5	26	13	6	21	54
	31	3	48	40	24	09	55	4	37	04	16	32	50	5	08	50	5	03	51	5	26	13	6	21	53
Feb.	10	3	48	40	24	09	55	4	37	04	16	32	50	5	08	50	5	03	52	5	26	12	6	21	53
	20	3	48	40	24	09	55	4	37	04	16	32	49	5	08	50	5	03	52	5	26	12	6	21	52
Mar.	1	3	48	40	+24	09	54	4	37	04	+16	32	49	5	08	50	-5	03	53	5	26	12	+6	21	52
	11	3	48	40	24	09	54	4	37	04	16	32	49	5	08	50	5	03	53	5	26	12	6	21	52
	21	3	48	40	24	09	54	4	37	03	16	32	49	5	08	49	5	03	53	5	26	12	6	21	52
	31	3	48	39	24	09	53	4	37	03	16	32	49	5	08	49	5	03	52	5	26	12	6	21	52
Apr.	10	3	48	39	24	09	52	4	37	03	16	32	49	5	08	49	5	03	52	5	26	11	6	21	53
	20	3	48	39	24	09	52	4	37	03	16	32	49	5	08	49	5	03	51	5	26	11	6	21	53
	30	3	48	39	+24	09	52	4	37	03	+16	32	49	5	08	49	-5	03	50	5	26	11	+6	21	53
May	10	3	48	39	24	09	51	4	37	03	16	32	49	5	08	49	5	03	49	5	26	11	6	21	54
	20	3	48	39	24	09	51	4	37	03	16	32	49	5	08	49	5	03	47	5	26	11	6	21	55
	30	3	48	39	24	09	52	4	37	03	16	32	50	5	08	49	5	03	46	5	26	11	6	21	56
June	9	3	48	40	24	09	52	4	37	03	16	32	50	5	08	49	5	03	44	5	26	11	6	21	57
	19	3	48	40	24	09	52	4	37	03	16	32	51	5	08	49	5	03	42	5	26	11	6	21	58
	29	3	48	40	+24	09	53	4	37	04	+16	32	52	5	08	49	-5	03	40	5	26	12	+6	21	59
July	9	3	48	40	24	09	54	4	37	04	16	32	53	5	08	50	5	03	38	5	26	12	6	22	01
	19	3	48	41	24	09	55	4	37	04	16	32	54	5	08	50	5	03	37	5	26	12	6	22	02
	29	3	48	41	24	09	56	4	37	04	16	32	55	5	08	50	5	03	35	5	26	12	6	22	03
Aug.	8	3	48	41	24	09	57	4	37	05	16	32	56	5	08	50	5	03	33	5	26	12	6	22	04
	18	3	48	42	24	09	58	4	37	05	16	32	57	5	08	51	5	03	32	5	26	13	6	22	05
	28	3	48	42	+24	09	59	4	37	05	+16	32	58	5	08	51	-5	03	31	5	26	13	+6	22	06
Sept.	7	3	48	42	24	10	01	4	37	06	16	32	58	5	08	51	5	03	30	5	26	13	6	22	07
	17	3	48	43	24	10	02	4	37	06	16	32	59	5	08	51	5	03	29	5	26	14	6	22	07
	27	3	48	43	24	10	03	4	37	06	16	32	60	5	08	52	5	03	29	5	26	14	6	22	07
Oct.	7	3	48	43	24	10	04	4	37	06	16	32	60	5	08	52	5	03	30	5	26	14	6	22	07
	17	3	48	43	24	10	05	4	37	07	16	33	00	5	08	52	5	03	30	5	26	14	6	22	07
	27	3	48	44	+24	10	06	4	37	07	+16	33	01	5	08	52	-5	03	31	5	26	15	+6	22	07
Nov.	6	3	48	44	24	10	06	4	37	07	16	33	01	5	08	53	5	03	32	5	26	15	6	22	06
	16	3	48	44	24	10	07	4	37	07	16	33	00	5	08	53	5	03	34	5	26	15	6	22	05
	26	3	48	44	24	10	07	4	37	08	16	33	01	5	08	53	5	03	35	5	26	15	6	22	04
Dec.	6	3	48	44	24	10	08	4	37	08	16	33	00	5	08	53	5	03	37	5	26	16	6	22	03
	16	3	48	44	24	10	08	4	37	08	16	33	00	5	08	53	5	03	38	5	26	16	6	22	02
	26	3	48	44	+24	10	08	4	37	08	+16	32	60	5	08	53	-5	03	40	5	26	16	+6	22	01
	36	3	48	44	+24	10	09	4	37	08	+16	32	60	5	08	53	-5	03	41	5	26	16	+6	22	01

APPARENT PLACES OF STARS, 2020

FOR 0^h TERRESTRIAL TIME

Name		β Leporis						ι Orionis						α Columbae						κ Orionis					
Mag. Spect.		2.84			G5 II			2.77			O9 III			2.64			B5 Ive			2.06			B0Iab		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	5	29	07	-20	44	46	5	36	25	-5	53	57	5	40	23	-34	03	58	5	48	43	-9	39	53
	11	5	29	07	20	44	49	5	36	25	5	53	59	5	40	23	34	04	01	5	48	43	9	39	55
	21	5	29	07	20	44	50	5	36	25	5	54	00	5	40	23	34	04	03	5	48	43	9	39	57
	31	5	29	07	20	44	52	5	36	25	5	54	01	5	40	23	34	04	05	5	48	43	9	39	58
Feb.	10	5	29	07	20	44	53	5	36	25	5	54	02	5	40	23	34	04	07	5	48	43	9	39	59
	20	5	29	06	20	44	54	5	36	25	5	54	03	5	40	23	34	04	08	5	48	43	9	40	00
Mar.	1	5	29	06	-20	44	55	5	36	25	-5	54	03	5	40	23	-34	04	09	5	48	42	-9	40	00
	11	5	29	06	20	44	55	5	36	24	5	54	03	5	40	22	34	04	09	5	48	42	9	40	00
	21	5	29	06	20	44	55	5	36	24	5	54	03	5	40	22	34	04	09	5	48	42	9	40	00
	31	5	29	06	20	44	54	5	36	24	5	54	03	5	40	22	34	04	08	5	48	42	9	40	00
Apr.	10	5	29	05	20	44	53	5	36	24	5	54	02	5	40	22	34	04	07	5	48	42	9	40	01
	20	5	29	05	20	44	52	5	36	24	5	54	01	5	40	21	34	04	06	5	48	41	9	39	59
	30	5	29	05	-20	44	51	5	36	24	-5	54	00	5	40	21	-34	04	04	5	48	41	-9	39	58
May	10	5	29	05	20	44	49	5	36	24	5	54	01	5	40	21	34	04	02	5	48	41	9	39	57
	20	5	29	05	20	44	47	5	36	24	5	53	58	5	40	21	34	04	01	5	48	41	9	39	55
	30	5	29	05	20	44	45	5	36	24	5	53	56	5	40	21	34	03	57	5	48	41	9	39	53
June	9	5	29	05	20	44	42	5	36	24	5	53	55	5	40	21	34	03	54	5	48	41	9	39	51
	19	5	29	05	20	44	40	5	36	24	5	53	53	5	40	21	34	03	51	5	48	41	9	39	50
	29	5	29	05	-20	44	37	5	36	24	-5	53	51	5	40	21	-34	03	48	5	48	41	-9	39	47
July	9	5	29	05	20	44	35	5	36	24	5	53	49	5	40	21	34	03	45	5	48	42	9	39	45
	19	5	29	06	20	44	32	5	36	24	5	53	47	5	40	22	34	03	42	5	48	42	9	39	44
	29	5	29	06	20	44	30	5	36	25	5	53	46	5	40	22	34	03	40	5	48	42	9	39	42
Aug.	8	5	29	06	20	44	28	5	36	25	5	53	44	5	40	22	34	03	37	5	48	42	9	39	40
	18	5	29	06	20	44	26	5	36	25	5	53	43	5	40	22	34	03	35	5	48	43	9	39	39
	28	5	29	07	-20	44	25	5	36	25	-5	53	42	5	40	23	-34	03	34	5	48	43	-9	39	37
Sept.	7	5	29	07	20	44	24	5	36	26	5	53	41	5	40	23	34	03	33	5	48	43	9	39	37
	17	5	29	07	20	44	23	5	36	26	5	53	40	5	40	23	34	03	32	5	48	43	9	39	36
	27	5	29	08	20	44	24	5	36	26	5	53	40	5	40	24	34	03	32	5	48	44	9	39	36
Oct.	7	5	29	08	20	44	24	5	36	26	5	53	41	5	40	24	34	03	33	5	48	44	9	39	36
	17	5	29	08	20	44	25	5	36	27	5	53	41	5	40	24	34	03	34	5	48	44	9	39	37
	27	5	29	08	-20	44	26	5	36	27	-5	53	42	5	40	25	-34	03	35	5	48	45	-9	39	38
Nov.	6	5	29	09	20	44	28	5	36	27	5	53	43	5	40	25	34	03	38	5	48	45	9	39	39
	16	5	29	09	20	44	30	5	36	27	5	53	45	5	40	25	34	03	40	5	48	45	9	39	41
	26	5	29	09	20	44	32	5	36	28	5	53	46	5	40	25	34	03	43	5	48	45	9	39	43
Dec.	6	5	29	09	20	44	35	5	36	28	5	53	48	5	40	25	34	03	46	5	48	45	9	39	45
	16	5	29	09	20	44	37	5	36	28	5	53	50	5	40	26	34	03	49	5	48	46	9	39	47
	26	5	29	09	-20	44	40	5	36	28	-5	53	51	5	40	26	-34	03	52	5	48	46	-9	39	48
	36	5	29	09	-20	44	42	5	36	28	-5	53	53	5	40	26	-34	03	54	5	48	46	-9	39	50

APPARENT PLACES OF STARS, 2020

FOR 0^h TERRESTRIAL TIME

Name		α Orionis						ζ Canis Majoris						α Carinae						γ Geminorum					
Mag. Spect.		0.4 - 1.3			M2Iab			3.02			B2.5V			-0.72			F0II			1.93			A0 IV		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	5	56	16	+7	24	30	6	21	36	+30	03	10	6	24	26	-52	42	28	6	38	52	+16	22	47
	11	5	56	16	7	24	29	6	21	36	30	03	10	6	24	26	52	42	32	6	38	52	16	22	47
	21	5	56	16	7	24	29	6	21	36	30	03	11	6	24	26	52	42	35	6	38	52	16	22	47
	31	5	56	16	7	24	28	6	21	36	30	03	12	6	24	25	52	42	37	6	38	52	16	22	47
Feb.	10	5	56	16	7	24	28	6	21	36	30	03	12	6	24	25	52	42	40	6	38	52	16	22	47
	20	5	56	15	7	24	28	6	21	36	30	03	13	6	24	25	52	42	42	6	38	52	16	22	47
Mar.	1	5	56	15	+7	24	28	6	21	36	+30	03	14	6	24	25	-52	42	43	6	38	52	+16	22	47
	11	5	56	15	7	24	28	6	21	36	30	03	14	6	24	24	52	42	44	6	38	52	16	22	47
	21	5	56	15	7	24	28	6	21	35	30	03	14	6	24	24	52	42	45	6	38	52	16	22	47
	31	5	56	15	7	24	28	6	21	35	30	03	14	6	24	24	52	42	45	6	38	52	16	22	47
Apr.	10	5	56	15	7	24	28	6	21	35	30	03	14	6	24	23	52	42	44	6	38	51	16	22	48
	20	5	56	14	7	24	28	6	21	35	30	03	14	6	24	23	52	42	43	6	38	51	16	22	48
	30	5	56	14	+7	24	29	6	21	35	+30	03	14	6	24	23	-52	42	42	6	38	51	+16	22	48
May	10	5	56	14	7	24	29	6	21	35	30	03	14	6	24	22	52	42	40	6	38	51	16	22	48
	20	5	56	14	7	24	30	6	21	35	30	03	13	6	24	22	52	42	37	6	38	51	16	22	49
	30	5	56	14	7	24	31	6	21	35	30	03	13	6	24	22	52	42	34	6	38	51	16	22	49
June	9	5	56	14	7	24	32	6	21	35	30	03	12	6	24	22	52	42	31	6	38	51	16	22	49
	19	5	56	14	7	24	33	6	21	35	30	03	12	6	24	22	52	42	28	6	38	51	16	22	49
	29	5	56	15	+7	24	34	6	21	35	+30	03	12	6	24	22	-52	42	25	6	38	51	+16	22	50
July	9	5	56	15	7	24	35	6	21	35	30	03	11	6	24	22	52	42	21	6	38	51	16	22	50
	19	5	56	15	7	24	36	6	21	35	30	03	11	6	24	22	52	42	18	6	38	51	16	22	51
	29	5	56	15	7	24	37	6	21	35	30	03	11	6	24	22	52	42	15	6	38	52	16	22	51
Aug.	8	5	56	15	7	24	38	6	21	36	30	03	11	6	24	23	52	42	12	6	38	52	16	22	52
	18	5	56	16	7	24	39	6	21	36	30	03	11	6	24	23	52	42	10	6	38	52	16	22	52
	28	5	56	16	+7	24	39	6	21	36	+30	03	10	6	24	23	-52	42	08	6	38	52	+16	22	52
Sept.	7	5	56	16	7	24	40	6	21	37	30	03	10	6	24	24	52	42	06	6	38	53	16	22	52
	17	5	56	17	7	24	41	6	21	37	30	03	10	6	24	24	52	42	05	6	38	53	16	22	52
	27	5	56	17	7	24	41	6	21	37	30	03	10	6	24	24	52	42	05	6	38	53	16	22	52
Oct.	7	5	56	17	7	24	40	6	21	38	30	03	10	6	24	25	52	42	05	6	38	54	16	22	52
	17	5	56	17	7	24	40	6	21	38	30	03	10	6	24	25	52	42	06	6	38	54	16	22	51
	27	5	56	18	+7	24	40	6	21	38	+30	03	10	6	24	26	-52	42	07	6	38	54	+16	22	51
Nov.	6	5	56	18	7	24	39	6	21	39	30	03	10	6	24	26	52	42	10	6	38	55	16	22	50
	16	5	56	18	7	24	38	6	21	39	30	03	10	6	24	26	52	42	12	6	38	55	16	22	49
	26	5	56	18	7	24	37	6	21	39	30	03	10	6	24	26	52	42	15	6	38	55	16	22	49
Dec.	6	5	56	19	7	24	36	6	21	40	30	03	10	6	24	27	52	42	18	6	38	55	16	22	48
	16	5	56	19	7	24	35	6	21	40	30	03	10	6	24	27	52	42	22	6	38	56	16	22	47
	26	5	56	19	+7	24	34	6	21	40	+30	03	11	6	24	27	-52	42	25	6	38	56	+16	22	47
	36	5	56	19	+7	24	33	6	21	40	+30	03	11	6	24	27	-52	42	29	6	38	56	+16	22	47

APPARENT PLACES OF STARS, 2020

FOR 0^h TERRESTRIAL TIME

Name		α Canis Majoris A						o^2 Canis Majoris						β Canis Minoris						α Canis Minoris A					
Mag. Spect.		-1.46			A1V			3.02			B3 Ia			2.90			B8Ve			0.38			F5 IV-V		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	6	46	02	-16	44	43	7	03	52	-23	51	49	7	28	14	+8	14	50	7	40	21	+5	10	19
	11	6	46	02	16	44	45	7	03	52	23	51	51	7	28	15	8	14	49	7	40	21	5	10	18
	21	6	46	02	16	44	47	7	03	52	23	51	54	7	28	15	8	14	48	7	40	21	5	10	17
	31	6	46	02	16	44	49	7	03	52	23	51	56	7	28	15	8	14	48	7	40	21	5	10	16
Feb.	10	6	46	02	16	44	50	7	03	52	23	51	58	7	28	15	8	14	47	7	40	21	5	10	15
	20	6	46	02	16	44	52	7	03	52	23	52	00	7	28	15	8	14	47	7	40	21	5	10	15
Mar.	1	6	46	02	-16	44	53	7	03	52	-23	52	01	7	28	14	+8	14	46	7	40	21	+5	10	15
	11	6	46	02	16	44	53	7	03	52	23	52	02	7	28	14	8	14	47	7	40	21	5	10	15
	21	6	46	02	16	44	54	7	03	52	23	52	03	7	28	14	8	14	46	7	40	21	5	10	14
	31	6	46	02	16	44	54	7	03	52	23	52	03	7	28	14	8	14	47	7	40	21	5	10	15
Apr.	10	6	46	01	16	44	53	7	03	51	23	52	02	7	28	14	8	14	47	7	40	21	5	10	15
	20	6	46	01	16	44	53	7	03	51	23	52	02	7	28	14	8	14	47	7	40	21	5	10	15
	30	6	46	01	-16	44	52	7	03	51	-23	52	01	7	28	14	+8	14	48	7	40	20	+5	10	15
May	10	6	46	01	16	44	51	7	03	51	23	52	00	7	28	13	8	14	48	7	40	20	5	10	16
	20	6	46	01	16	44	49	7	03	51	23	51	58	7	28	13	8	14	49	7	40	20	5	10	17
	30	6	46	01	16	44	47	7	03	51	23	51	56	7	28	13	8	14	49	7	40	20	5	10	17
June	9	6	46	01	16	44	46	7	03	51	23	51	54	7	28	13	8	14	50	7	40	20	5	10	18
	19	6	46	01	16	44	43	7	03	51	23	51	52	7	28	13	8	14	51	7	40	20	5	10	19
	29	6	46	01	-16	44	41	7	03	51	-23	51	50	7	28	13	+8	14	52	7	40	20	+5	10	20
July	9	6	46	01	16	44	39	7	03	51	23	51	47	7	28	13	8	14	52	7	40	20	5	10	21
	19	6	46	01	16	44	37	7	03	51	23	51	45	7	28	14	8	14	53	7	40	20	5	10	21
	29	6	46	01	16	44	35	7	03	51	23	51	42	7	28	14	8	14	54	7	40	20	5	10	22
Aug.	8	6	46	01	16	44	33	7	03	51	23	51	40	7	28	14	8	14	54	7	40	21	5	10	23
	18	6	46	02	16	44	32	7	03	51	23	51	38	7	28	14	8	14	55	7	40	21	5	10	24
	28	6	46	02	-16	44	30	7	03	52	-23	51	37	7	28	14	+8	14	55	7	40	21	+5	10	24
Sept.	7	6	46	02	16	44	29	7	03	52	23	51	35	7	28	14	8	14	55	7	40	21	5	10	24
	17	6	46	02	16	44	29	7	03	52	23	51	34	7	28	15	8	14	55	7	40	21	5	10	24
	27	6	46	03	16	44	29	7	03	52	23	51	34	7	28	15	8	14	55	7	40	22	5	10	24
Oct.	7	6	46	03	16	44	29	7	03	53	23	51	34	7	28	15	8	14	55	7	40	22	5	10	24
	17	6	46	03	16	44	29	7	03	53	23	51	35	7	28	16	8	14	54	7	40	22	5	10	23
	27	6	46	04	-16	44	31	7	03	53	-23	51	36	7	28	16	+8	14	53	7	40	23	+5	10	22
Nov.	6	6	46	04	16	44	32	7	03	54	23	51	38	7	28	16	8	14	52	7	40	23	5	10	21
	16	6	46	04	16	44	34	7	03	54	23	51	40	7	28	17	8	14	51	7	40	23	5	10	19
	26	6	46	04	16	44	36	7	03	54	23	51	42	7	28	17	8	14	50	7	40	24	5	10	18
Dec.	6	6	46	05	16	44	39	7	03	54	23	51	44	7	28	17	8	14	48	7	40	24	5	10	16
	16	6	46	05	16	44	41	7	03	55	23	51	47	7	28	17	8	14	47	7	40	24	5	10	15
	26	6	46	05	-16	44	44	7	03	55	-23	51	50	7	28	18	+8	14	46	7	40	24	+5	10	13
	36	6	46	05	-16	44	46	7	03	55	-23	51	52	7	28	18	+8	14	45	7	40	24	+5	10	12

APPARENT PLACES OF STARS, 2020

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Name		β Geminorum						ξ Puppis						ρ Puppis						ζ Hydrae					
Mag. Spect.		1.14			K0IIIb			3.34			G6 Ia			2.81			F6IIp			3.11			G9 II-III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	7	46	33	+27	58	32	7	50	09	-24	54	36	8	08	24	-24	21	42	8	56	27	+5	52	07
	11	7	46	33	27	58	32	7	50	09	24	54	39	8	08	25	24	21	45	8	56	27	5	52	05
	21	7	46	33	27	58	32	7	50	09	24	54	42	8	08	25	24	21	48	8	56	27	5	52	04
	31	7	46	33	27	58	33	7	50	09	24	54	44	8	08	25	24	21	50	8	56	28	5	52	03
Feb.	10	7	46	33	27	58	34	7	50	09	24	54	46	8	08	25	24	21	53	8	56	28	5	52	02
	20	7	46	33	27	58	34	7	50	09	24	54	48	8	08	25	24	21	55	8	56	28	5	52	01
Mar.	1	7	46	33	+27	58	35	7	50	09	-24	54	50	8	08	25	-24	21	56	8	56	28	+5	52	01
	11	7	46	33	27	58	36	7	50	09	24	54	51	8	08	24	24	21	58	8	56	28	5	52	01
	21	7	46	32	27	58	37	7	50	09	24	54	52	8	08	24	24	21	59	8	56	28	5	52	01
	31	7	46	32	27	58	37	7	50	08	24	54	53	8	08	24	24	22	01	8	56	27	5	52	01
Apr.	10	7	46	32	27	58	38	7	50	08	24	54	53	8	08	24	24	22	00	8	56	27	5	52	02
	20	7	46	32	27	58	38	7	50	08	24	54	53	8	08	24	24	22	00	8	56	27	5	52	02
	30	7	46	32	+27	58	38	7	50	08	-24	54	52	8	08	23	-24	22	01	8	56	27	+5	52	02
May	10	7	46	32	27	58	38	7	50	08	24	54	51	8	08	23	24	21	59	8	56	27	5	52	03
	20	7	46	31	27	58	38	7	50	07	24	54	50	8	08	23	24	21	57	8	56	27	5	52	03
	30	7	46	31	27	58	38	7	50	07	24	54	49	8	08	23	24	21	56	8	56	27	5	52	04
June	9	7	46	31	27	58	38	7	50	07	24	54	47	8	08	23	24	21	54	8	56	27	5	52	05
	19	7	46	31	27	58	38	7	50	07	24	54	45	8	08	23	24	21	52	8	56	26	5	52	05
	29	7	46	31	+27	58	37	7	50	07	-24	54	42	8	08	23	-24	21	50	8	56	26	+5	52	06
July	9	7	46	31	27	58	37	7	50	07	24	54	40	8	08	23	24	21	48	8	56	26	5	52	07
	19	7	46	32	27	58	36	7	50	07	24	54	38	8	08	23	24	21	46	8	56	26	5	52	07
	29	7	46	32	27	58	36	7	50	07	24	54	36	8	08	23	24	21	44	8	56	27	5	52	08
Aug.	8	7	46	32	27	58	35	7	50	08	24	54	33	8	08	23	24	21	41	8	56	27	5	52	08
	18	7	46	32	27	58	34	7	50	08	24	54	31	8	08	23	24	21	40	8	56	27	5	52	09
	28	7	46	32	+27	58	34	7	50	08	-24	54	30	8	08	23	-24	21	38	8	56	27	+5	52	09
Sept.	7	7	46	33	27	58	33	7	50	08	24	54	28	8	08	24	24	21	36	8	56	27	5	52	09
	17	7	46	33	27	58	32	7	50	08	24	54	27	8	08	24	24	21	35	8	56	27	5	52	09
	27	7	46	33	27	58	31	7	50	09	24	54	27	8	08	24	24	21	35	8	56	28	5	52	08
Oct.	7	7	46	34	27	58	31	7	50	09	24	54	26	8	08	24	24	21	34	8	56	28	5	52	08
	17	7	46	34	27	58	30	7	50	09	24	54	27	8	08	25	24	21	35	8	56	28	5	52	07
	27	7	46	34	+27	58	29	7	50	10	-24	54	28	8	08	25	-24	21	35	8	56	28	+5	52	05
Nov.	6	7	46	35	27	58	28	7	50	10	24	54	29	8	08	25	24	21	37	8	56	29	5	52	04
	16	7	46	35	27	58	27	7	50	10	24	54	31	8	08	26	24	21	39	8	56	29	5	52	03
	26	7	46	35	27	58	27	7	50	10	24	54	33	8	08	26	24	21	41	8	56	29	5	52	01
Dec.	6	7	46	36	27	58	26	7	50	11	24	54	36	8	08	26	24	21	43	8	56	30	5	51	59
	16	7	46	36	27	58	26	7	50	11	24	54	38	8	08	27	24	21	46	8	56	30	5	51	57
	26	7	46	36	+27	58	26	7	50	11	-24	54	41	8	08	27	-24	21	49	8	56	30	+5	51	56
	36	7	46	36	+27	58	26	7	50	11	-24	54	44	8	08	27	-24	21	51	8	56	30	+5	51	54

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Name		λ Velorum						α Hydrae						α Leonis						α Antliae					
Mag. Spect.		2.21			K4 Ib-II			1.98			K3 II-III			1.35			B7 V			4.25			K4 III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	9	08	45	-43	30	38	9	28	34	-8	44	40	10	09	26	+11	52	08	10	28	04	-31	09	58
	11	9	08	45	43	30	42	9	28	35	8	44	43	10	09	26	11	52	06	10	28	05	31	10	01
	21	9	08	45	43	30	45	9	28	35	8	44	45	10	09	26	11	52	05	10	28	05	31	10	04
	31	9	08	45	43	30	49	9	28	35	8	44	47	10	09	27	11	52	04	10	28	05	31	10	07
Feb.	10	9	08	45	43	30	52	9	28	35	8	44	49	10	09	27	11	52	03	10	28	05	31	10	10
	20	9	08	45	43	30	55	9	28	35	8	44	50	10	09	27	11	52	03	10	28	05	31	10	13
Mar.	1	9	08	45	-43	30	58	9	28	35	-8	44	51	10	09	27	+11	52	03	10	28	05	-31	10	16
	11	9	08	45	43	31	00	9	28	35	8	44	52	10	09	27	11	52	03	10	28	05	31	10	18
	21	9	08	45	43	31	03	9	28	35	8	44	53	10	09	27	11	52	03	10	28	05	31	10	20
	31	9	08	45	43	31	04	9	28	35	8	44	54	10	09	27	11	52	04	10	28	05	31	10	22
Apr.	10	9	08	45	43	31	06	9	28	35	8	44	54	10	09	27	11	52	05	10	28	05	31	10	23
	20	9	08	44	43	31	07	9	28	35	8	44	54	10	09	27	11	52	05	10	28	05	31	10	25
	30	9	08	44	-43	31	07	9	28	34	-8	44	54	10	09	26	+11	52	06	10	28	05	-31	10	25
May	10	9	08	44	43	31	07	9	28	34	8	44	53	10	09	26	11	52	06	10	28	05	31	10	26
	20	9	08	44	43	31	06	9	28	34	8	44	53	10	09	26	11	52	07	10	28	04	31	10	26
	30	9	08	43	43	31	05	9	28	34	8	44	52	10	09	26	11	52	08	10	28	04	31	10	26
June	9	9	08	43	43	31	04	9	28	34	8	44	51	10	09	26	11	52	08	10	28	04	31	10	25
	19	9	08	43	43	31	02	9	28	34	8	44	50	10	09	26	11	52	09	10	28	04	31	10	24
	29	9	08	43	-43	31	00	9	28	34	-8	44	49	10	09	26	+11	52	09	10	28	04	-31	10	23
July	9	9	08	43	43	30	58	9	28	34	8	44	48	10	09	26	11	52	09	10	28	04	31	10	21
	19	9	08	43	43	30	55	9	28	34	8	44	47	10	09	26	11	52	10	10	28	04	31	10	19
	29	9	08	43	43	30	53	9	28	34	8	44	45	10	09	26	11	52	10	10	28	04	31	10	17
Aug.	8	9	08	43	43	30	50	9	28	34	8	44	44	10	09	26	11	52	10	10	28	04	31	10	15
	18	9	08	43	43	30	47	9	28	34	8	44	43	10	09	26	11	52	09	10	28	04	31	10	13
	28	9	08	43	-43	30	45	9	28	34	-8	44	42	10	09	26	+11	52	09	10	28	04	-31	10	11
Sept.	7	9	08	43	43	30	42	9	28	34	8	44	41	10	09	26	11	52	09	10	28	04	31	10	09
	17	9	08	43	43	30	40	9	28	34	8	44	41	10	09	26	11	52	08	10	28	04	31	10	08
	27	9	08	44	43	30	39	9	28	34	8	44	41	10	09	26	11	52	07	10	28	04	31	10	07
Oct.	7	9	08	44	43	30	38	9	28	35	8	44	41	10	09	27	11	52	06	10	28	04	31	10	05
	17	9	08	44	43	30	37	9	28	35	8	44	41	10	09	27	11	52	05	10	28	04	31	10	05
	27	9	08	45	-43	30	37	9	28	35	-8	44	42	10	09	27	+11	52	03	10	28	05	-31	10	05
Nov.	6	9	08	45	43	30	38	9	28	36	8	44	43	10	09	27	11	52	01	10	28	05	31	10	05
	16	9	08	45	43	30	39	9	28	36	8	44	45	10	09	28	11	51	59	10	28	05	31	10	06
	26	9	08	46	43	30	41	9	28	36	8	44	47	10	09	28	11	51	58	10	28	06	31	10	07
Dec.	6	9	08	46	43	30	43	9	28	37	8	44	49	10	09	28	11	51	56	10	28	06	31	10	09
	16	9	08	47	43	30	46	9	28	37	8	44	51	10	09	29	11	51	54	10	28	06	31	10	12
	26	9	08	47	-43	30	49	9	28	37	-8	44	53	10	09	29	+11	51	52	10	28	07	-31	10	14
	36	9	08	47	-43	30	53	9	28	37	-8	44	55	10	09	29	+11	51	51	10	28	07	-31	10	17

APPARENT PLACES OF STARS, 2020

FOR 0^h TERRESTRIAL TIME

Name		ν Hydrae						ξ Hydrae						β Leonis						γ Corvi					
Mag. Spect.		3.11			K0/K1III			3.54			G7 III			2.14			A3 V			2.59			B8III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	10	50	37	-16	17	45	11	33	59	-31	57	50	11	50	04	+14	27	37	12	16	49	-17	38	58
	11	10	50	37	16	17	47	11	33	59	31	57	52	11	50	04	14	27	35	12	16	50	17	39	00
	21	10	50	37	16	17	50	11	33	60	31	57	55	11	50	05	14	27	34	12	16	50	17	39	02
	31	10	50	37	16	17	52	11	33	60	31	57	58	11	50	05	14	27	32	12	16	50	17	39	05
Feb.	10	10	50	37	16	17	55	11	34	00	31	58	01	11	50	05	14	27	31	12	16	51	17	39	07
	20	10	50	38	16	17	57	11	34	00	31	58	04	11	50	05	14	27	31	12	16	51	17	39	09
Mar.	1	10	50	38	-16	17	58	11	34	00	-31	58	06	11	50	05	+14	27	31	12	16	51	-17	39	11
	11	10	50	38	16	18	00	11	34	00	31	58	09	11	50	06	14	27	31	12	16	51	17	39	13
	21	10	50	38	16	18	02	11	34	01	31	58	11	11	50	06	14	27	31	12	16	51	17	39	14
	31	10	50	38	16	18	03	11	34	01	31	58	13	11	50	06	14	27	32	12	16	51	17	39	16
Apr.	10	10	50	38	16	18	03	11	34	00	31	58	15	11	50	06	14	27	33	12	16	51	17	39	17
	20	10	50	38	16	18	04	11	34	00	31	58	17	11	50	06	14	27	34	12	16	51	17	39	18
	30	10	50	37	-16	18	04	11	34	00	-31	58	18	11	50	06	+14	27	35	12	16	51	-17	39	18
May	10	10	50	37	16	18	05	11	34	00	31	58	19	11	50	05	14	27	36	12	16	51	17	39	19
	20	10	50	37	16	18	04	11	34	00	31	58	19	11	50	05	14	27	37	12	16	51	17	39	19
	30	10	50	37	16	18	04	11	33	60	31	58	19	11	50	05	14	27	38	12	16	51	17	39	19
June	9	10	50	37	16	18	03	11	33	60	31	58	19	11	50	05	14	27	38	12	16	51	17	39	19
	19	10	50	37	16	18	02	11	33	60	31	58	19	11	50	05	14	27	39	12	16	51	17	39	18
	29	10	50	37	-16	18	02	11	33	59	-31	58	18	11	50	05	+14	27	40	12	16	51	-17	39	17
July	9	10	50	37	16	18	01	11	33	59	31	58	17	11	50	05	14	27	40	12	16	51	17	39	17
	19	10	50	37	16	18	01	11	33	59	31	58	16	11	50	05	14	27	40	12	16	50	17	39	16
	29	10	50	36	16	17	58	11	33	59	31	58	14	11	50	05	14	27	40	12	16	50	17	39	15
Aug.	8	10	50	36	16	17	57	11	33	59	31	58	13	11	50	05	14	27	40	12	16	50	17	39	14
	18	10	50	36	16	17	55	11	33	59	31	58	11	11	50	05	14	27	40	12	16	50	17	39	13
	28	10	50	36	-16	17	54	11	33	59	-31	58	09	11	50	05	+14	27	39	12	16	50	-17	39	12
Sept.	7	10	50	37	16	17	53	11	33	59	31	58	07	11	50	05	14	27	38	12	16	50	17	39	11
	17	10	50	37	16	17	52	11	33	59	31	58	06	11	50	05	14	27	37	12	16	50	17	39	10
	27	10	50	37	16	17	52	11	33	59	31	58	04	11	50	05	14	27	36	12	16	50	17	39	10
Oct.	7	10	50	37	16	17	51	11	33	59	31	58	03	11	50	05	14	27	35	12	16	50	17	39	09
	17	10	50	37	16	17	51	11	33	59	31	58	02	11	50	05	14	27	33	12	16	50	17	39	09
	27	10	50	37	-16	17	52	11	33	60	-31	58	02	11	50	05	+14	27	31	12	16	51	-17	39	09
Nov.	6	10	50	38	16	17	53	11	33	60	31	58	01	11	50	05	14	27	29	12	16	51	17	39	09
	16	10	50	38	16	17	54	11	34	00	31	58	02	11	50	06	14	27	27	12	16	51	17	39	10
	26	10	50	38	16	17	55	11	34	01	31	58	03	11	50	06	14	27	24	12	16	51	17	39	11
Dec.	6	10	50	39	16	17	57	11	34	01	31	58	04	11	50	06	14	27	22	12	16	52	17	39	13
	16	10	50	39	16	18	01	11	34	01	31	58	06	11	50	07	14	27	20	12	16	52	17	39	15
	26	10	50	39	-16	18	02	11	34	02	-31	58	08	11	50	07	+14	27	18	12	16	52	-17	39	17
	36	10	50	40	-16	18	04	11	34	02	-31	58	11	11	50	07	+14	27	16	12	16	53	-17	39	19

APPARENT PLACES OF STARS, 2020

FOR 0^h TERRESTRIAL TIME

Name		β Corvi						δ Virginis						ε Virginis						ι Centauri					
Mag. Spect.		2.65			G5 II			3.38			M3III			2.83			G8 III			2.75			kA15hA3nA3va		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	12	35	26	-23	30	11	12	56	36	+3	17	25	13	03	09	+10	51	09	13	21	42	-36	48	43
	11	12	35	26	23	30	13	12	56	36	3	17	23	13	03	10	10	51	07	13	21	43	36	48	45
	21	12	35	26	23	30	15	12	56	36	3	17	21	13	03	10	10	51	05	13	21	43	36	48	47
	31	12	35	27	23	30	18	12	56	37	3	17	19	13	03	10	10	51	03	13	21	43	36	48	49
Feb.	10	12	35	27	23	30	20	12	56	37	3	17	18	13	03	10	10	51	02	13	21	44	36	48	52
	20	12	35	27	23	30	23	12	56	37	3	17	17	13	03	11	10	51	01	13	21	44	36	48	54
Mar.	1	12	35	27	-23	30	25	12	56	37	+3	17	16	13	03	11	+10	51	01	13	21	44	-36	48	56
	11	12	35	27	23	30	27	12	56	37	3	17	15	13	03	11	10	51	01	13	21	45	36	48	59
	21	12	35	28	23	30	29	12	56	38	3	17	15	13	03	11	10	51	01	13	21	45	36	49	01
	31	12	35	28	23	30	30	12	56	38	3	17	15	13	03	11	10	51	01	13	21	45	36	49	04
Apr.	10	12	35	28	23	30	32	12	56	38	3	17	15	13	03	11	10	51	02	13	21	45	36	49	06
	20	12	35	28	23	30	33	12	56	38	3	17	15	13	03	11	10	51	03	13	21	45	36	49	08
	30	12	35	28	-23	30	34	12	56	38	+3	17	16	13	03	11	+10	51	04	13	21	45	-36	49	10
May	10	12	35	28	23	30	35	12	56	38	3	17	17	13	03	11	10	51	05	13	21	45	36	49	11
	20	12	35	27	23	30	35	12	56	38	3	17	17	13	03	11	10	51	06	13	21	45	36	49	12
	30	12	35	27	23	30	35	12	56	38	3	17	18	13	03	11	10	51	07	13	21	45	36	49	13
June	9	12	35	27	23	30	35	12	56	38	3	17	19	13	03	11	10	51	08	13	21	45	36	49	14
	19	12	35	27	23	30	35	12	56	37	3	17	20	13	03	11	10	51	09	13	21	45	36	49	14
	29	12	35	27	-23	30	35	12	56	37	+3	17	20	13	03	11	+10	51	09	13	21	45	-36	49	15
July	9	12	35	27	23	30	34	12	56	37	3	17	21	13	03	11	10	51	10	13	21	44	36	49	15
	19	12	35	27	23	30	33	12	56	37	3	17	21	13	03	11	10	51	10	13	21	44	36	49	14
	29	12	35	27	23	30	32	12	56	37	3	17	22	13	03	11	10	51	11	13	21	44	36	49	13
Aug.	8	12	35	27	23	30	31	12	56	37	3	17	22	13	03	11	10	51	11	13	21	44	36	49	13
	18	12	35	27	23	30	30	12	56	37	3	17	22	13	03	11	10	51	11	13	21	44	36	49	11
	28	12	35	26	-23	30	29	12	56	37	+3	17	22	13	03	10	+10	51	10	13	21	44	-36	49	10
Sept.	7	12	35	26	23	30	28	12	56	37	3	17	22	13	03	10	10	51	10	13	21	44	36	49	08
	17	12	35	26	23	30	27	12	56	37	3	17	22	13	03	10	10	51	09	13	21	43	36	49	07
	27	12	35	26	23	30	26	12	56	37	3	17	21	13	03	10	10	51	08	13	21	43	36	49	05
Oct.	7	12	35	26	23	30	25	12	56	37	3	17	20	13	03	10	10	51	07	13	21	43	36	49	04
	17	12	35	27	23	30	24	12	56	37	3	17	19	13	03	10	10	51	05	13	21	43	36	49	02
	27	12	35	27	-23	30	24	12	56	37	+3	17	18	13	03	11	+10	51	03	13	21	44	-36	49	01
Nov.	6	12	35	27	23	30	24	12	56	37	3	17	16	13	03	11	10	51	02	13	21	44	36	49	00
	16	12	35	27	23	30	25	12	56	37	3	17	15	13	03	11	10	50	59	13	21	44	36	49	00
	26	12	35	27	23	30	26	12	56	38	3	17	13	13	03	11	10	50	57	13	21	44	36	49	00
Dec.	6	12	35	28	23	30	27	12	56	38	3	17	10	13	03	11	10	50	55	13	21	45	36	49	00
	16	12	35	28	23	30	28	12	56	38	3	17	08	13	03	12	10	50	52	13	21	45	36	49	01
	26	12	35	28	-23	30	30	12	56	38	+3	17	06	13	03	12	+10	50	50	13	21	45	-36	49	02
	36	12	35	29	-23	30	32	12	56	39	+3	17	04	13	03	12	+10	50	48	13	21	46	-36	49	04

APPARENT PLACES OF STARS, 2020

FOR 0^h TERRESTRIAL TIME

Name		α Virginis						θ Centauri						α^2 Librae						β Lupi					
Mag. Spect.		0.98			B1 III-V+			2.06			K0 III			2.75			KA2HA5MA4IV-V			2.68			B2 III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	13	26	14	-11	15	44	14	07	50	-36	27	45	14	51	57	-16	07	15	14	59	49	-43	12	30
	11	13	26	14	11	15	46	14	07	51	36	27	46	14	51	58	16	07	17	14	59	49	43	12	31
	21	13	26	14	11	15	48	14	07	51	36	27	48	14	51	58	16	07	18	14	59	50	43	12	31
	31	13	26	15	11	15	50	14	07	51	36	27	50	14	51	58	16	07	20	14	59	50	43	12	33
Feb.	10	13	26	15	11	15	52	14	07	52	36	27	52	14	51	59	16	07	22	14	59	50	43	12	34
	20	13	26	15	11	15	54	14	07	52	36	27	54	14	51	59	16	07	23	14	59	51	43	12	36
Mar.	1	13	26	15	-11	15	55	14	07	52	-36	27	56	14	51	59	-16	07	25	14	59	51	-43	12	38
	11	13	26	16	11	15	57	14	07	53	36	27	58	14	51	60	16	07	26	14	59	51	43	12	40
	21	13	26	16	11	15	58	14	07	53	36	28	01	14	51	60	16	07	27	14	59	52	43	12	42
	31	13	26	16	11	15	59	14	07	53	36	28	03	14	52	00	16	07	28	14	59	52	43	12	44
Apr.	10	13	26	16	11	16	01	14	07	53	36	28	05	14	52	00	16	07	29	14	59	52	43	12	46
	20	13	26	16	11	16	00	14	07	53	36	28	07	14	52	00	16	07	30	14	59	53	43	12	48
	30	13	26	16	-11	16	00	14	07	53	-36	28	08	14	52	01	-16	07	30	14	59	53	-43	12	50
May	10	13	26	16	11	16	00	14	07	54	36	28	10	14	52	01	16	07	30	14	59	53	43	12	52
	20	13	26	16	11	16	00	14	07	54	36	28	11	14	52	01	16	07	30	14	59	53	43	12	53
	30	13	26	16	11	16	00	14	07	54	36	28	13	14	52	01	16	07	31	14	59	53	43	12	55
June	9	13	26	16	11	16	00	14	07	53	36	28	13	14	52	01	16	07	31	14	59	53	43	12	56
	19	13	26	16	11	16	01	14	07	53	36	28	14	14	52	01	16	07	30	14	59	53	43	12	58
	29	13	26	16	-11	16	01	14	07	53	-36	28	15	14	52	01	-16	07	30	14	59	53	-43	12	59
July	9	13	26	16	11	15	59	14	07	53	36	28	15	14	52	01	16	07	30	14	59	53	43	13	01
	19	13	26	16	11	15	58	14	07	53	36	28	15	14	52	01	16	07	30	14	59	53	43	13	00
	29	13	26	15	11	15	57	14	07	53	36	28	14	14	52	00	16	07	29	14	59	52	43	13	00
Aug.	8	13	26	15	11	15	57	14	07	53	36	28	14	14	52	00	16	07	29	14	59	52	43	13	00
	18	13	26	15	11	15	56	14	07	52	36	28	13	14	52	00	16	07	29	14	59	52	43	13	01
	28	13	26	15	-11	15	56	14	07	52	-36	28	12	14	51	60	-16	07	28	14	59	52	-43	12	59
Sept.	7	13	26	15	11	15	55	14	07	52	36	28	11	14	51	60	16	07	28	14	59	52	43	12	58
	17	13	26	15	11	15	55	14	07	52	36	28	10	14	51	60	16	07	27	14	59	51	43	12	57
	27	13	26	15	11	15	55	14	07	52	36	28	08	14	51	60	16	07	27	14	59	51	43	12	55
Oct.	7	13	26	15	11	15	54	14	07	52	36	28	07	14	51	60	16	07	26	14	59	51	43	12	54
	17	13	26	15	11	15	55	14	07	52	36	28	05	14	51	59	16	07	26	14	59	51	43	12	52
	27	13	26	15	-11	15	55	14	07	52	-36	28	04	14	51	60	-16	07	27	14	59	51	-43	12	51
Nov.	6	13	26	15	11	15	56	14	07	52	36	28	03	14	51	60	16	07	27	14	59	51	43	12	49
	16	13	26	15	11	15	57	14	07	52	36	28	03	14	51	60	16	07	27	14	59	51	43	12	48
	26	13	26	16	11	15	58	14	07	53	36	28	02	14	51	60	16	07	28	14	59	51	43	12	47
Dec.	6	13	26	16	11	16	01	14	07	53	36	28	03	14	52	00	16	07	29	14	59	52	43	12	47
	16	13	26	16	11	16	01	14	07	53	36	28	03	14	52	00	16	07	30	14	59	52	43	12	46
	26	13	26	17	-11	16	03	14	07	53	-36	28	04	14	52	01	-16	07	31	14	59	52	-43	12	46
	36	13	26	17	-11	16	05	14	07	54	-36	28	05	14	52	01	-16	07	33	14	59	53	-43	12	47

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FOR 0^h TERRESTRIAL TIME

Name		β Librae						α Serpentis						δ Scorpii						δ Ophiuchi					
Mag. Spect.		2.61			B8 IV			2.65			K2 III b			2.32			B0.2 Ive			2.74			M0.5 III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	15	18	03	-9	27	12	15	45	13	+6	21	52	16	01	29	-22	40	29	16	15	22	-3	44	35
	11	15	18	04	9	27	14	15	45	14	6	21	50	16	01	29	22	40	29	16	15	22	3	44	37
	21	15	18	04	9	27	15	15	45	14	6	21	48	16	01	30	22	40	30	16	15	22	3	44	38
	31	15	18	04	9	27	17	15	45	14	6	21	46	16	01	30	22	40	32	16	15	22	3	44	40
Feb.	10	15	18	05	9	27	19	15	45	15	6	21	45	16	01	30	22	40	33	16	15	23	3	44	42
	20	15	18	05	9	27	20	15	45	15	6	21	43	16	01	31	22	40	34	16	15	23	3	44	43
Mar.	1	15	18	05	-9	27	21	15	45	15	+6	21	42	16	01	31	-22	40	35	16	15	23	-3	44	44
	11	15	18	05	9	27	22	15	45	15	6	21	42	16	01	31	22	40	36	16	15	24	3	44	45
	21	15	18	06	9	27	23	15	45	16	6	21	42	16	01	31	22	40	37	16	15	24	3	44	45
	31	15	18	06	9	27	23	15	45	16	6	21	42	16	01	32	22	40	38	16	15	24	3	44	45
Apr.	10	15	18	06	9	27	24	15	45	16	6	21	42	16	01	32	22	40	39	16	15	24	3	44	45
	20	15	18	06	9	27	24	15	45	16	6	21	43	16	01	32	22	40	39	16	15	25	3	44	45
	30	15	18	06	-9	27	24	15	45	16	+6	21	44	16	01	32	-22	40	40	16	15	25	-3	44	44
May	10	15	18	06	9	27	24	15	45	17	6	21	45	16	01	33	22	40	40	16	15	25	3	44	44
	20	15	18	07	9	27	24	15	45	17	6	21	46	16	01	33	22	40	41	16	15	25	3	44	43
	30	15	18	07	9	27	23	15	45	17	6	21	48	16	01	33	22	40	41	16	15	25	3	44	42
June	9	15	18	07	9	27	23	15	45	17	6	21	49	16	01	33	22	40	41	16	15	25	3	44	41
	19	15	18	07	9	27	22	15	45	17	6	21	50	16	01	33	22	40	42	16	15	25	3	44	41
	29	15	18	07	-9	27	22	15	45	17	+6	21	51	16	01	33	-22	40	42	16	15	25	-3	44	40
July	9	15	18	07	9	27	22	15	45	17	6	21	52	16	01	33	22	40	42	16	15	25	3	44	39
	19	15	18	06	9	27	21	15	45	17	6	21	53	16	01	33	22	40	42	16	15	25	3	44	38
	29	15	18	06	9	27	21	15	45	17	6	21	54	16	01	33	22	40	42	16	15	25	3	44	38
Aug.	8	15	18	06	9	27	21	15	45	16	6	21	54	16	01	33	22	40	42	16	15	25	3	44	38
	18	15	18	06	9	27	20	15	45	16	6	21	55	16	01	32	22	40	42	16	15	25	3	44	37
	28	15	18	06	-9	27	20	15	45	16	+6	21	55	16	01	32	-22	40	42	16	15	25	-3	44	37
Sept.	7	15	18	06	9	27	20	15	45	16	6	21	55	16	01	32	22	40	41	16	15	25	3	44	37
	17	15	18	06	9	27	19	15	45	16	6	21	55	16	01	32	22	40	41	16	15	25	3	44	37
	27	15	18	06	9	27	19	15	45	16	6	21	54	16	01	32	22	40	41	16	15	24	3	44	37
Oct.	7	15	18	05	9	27	19	15	45	16	6	21	54	16	01	32	22	40	40	16	15	24	3	44	37
	17	15	18	05	9	27	20	15	45	15	6	21	52	16	01	32	22	40	40	16	15	24	3	44	38
	27	15	18	05	-9	27	20	15	45	15	+6	21	51	16	01	32	-22	40	40	16	15	24	-3	44	38
Nov.	6	15	18	05	9	27	21	15	45	15	6	21	50	16	01	32	22	40	39	16	15	24	3	44	39
	16	15	18	05	9	27	21	15	45	15	6	21	48	16	01	32	22	40	39	16	15	24	3	44	40
	26	15	18	06	9	27	22	15	45	16	6	21	46	16	01	32	22	40	39	16	15	24	3	44	42
Dec.	6	15	18	06	9	27	24	15	45	16	6	21	44	16	01	32	22	40	40	16	15	24	3	44	43
	16	15	18	06	9	27	25	15	45	16	6	21	42	16	01	32	22	40	40	16	15	24	3	44	44
	26	15	18	06	-9	27	27	15	45	16	+6	21	40	16	01	32	-22	40	41	16	15	25	-3	44	46
	36	15	18	07	-9	27	28	15	45	16	+6	21	37	16	01	33	-22	40	42	16	15	25	-3	44	48

APPARENT PLACES OF STARS, 2020

FOR 0^h TERRESTRIAL TIME

Name		α Scorpii A						ζ Ophiuchi						ε Scorpii						θ Ophiuchi					
Mag. Spect.		0.9 - 1.8			M1.5 Iab-b			2.56			O9V			2.29			K1 III			3.27			B2 IV		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	16	30	36	-26	28	20	16	38	13	-10	36	17	16	51	25	-34	19	31	17	23	12	-25	00	59
	11	16	30	36	26	28	21	16	38	14	10	36	18	16	51	25	34	19	31	17	23	12	25	00	59
	21	16	30	36	26	28	21	16	38	14	10	36	19	16	51	26	34	19	31	17	23	12	25	01	01
	31	16	30	37	26	28	22	16	38	14	10	36	20	16	51	26	34	19	32	17	23	13	25	01	00
Feb.	10	16	30	37	26	28	23	16	38	15	10	36	22	16	51	26	34	19	32	17	23	13	25	01	00
	20	16	30	37	26	28	24	16	38	15	10	36	23	16	51	27	34	19	33	17	23	13	25	01	01
Mar.	1	16	30	38	-26	28	25	16	38	15	-10	36	24	16	51	27	-34	19	33	17	23	14	-25	01	01
	11	16	30	38	26	28	26	16	38	16	10	36	24	16	51	27	34	19	34	17	23	14	25	01	02
	21	16	30	38	26	28	27	16	38	16	10	36	25	16	51	28	34	19	35	17	23	14	25	01	02
	31	16	30	39	26	28	27	16	38	16	10	36	25	16	51	28	34	19	36	17	23	14	25	01	02
Apr.	10	16	30	39	26	28	28	16	38	16	10	36	25	16	51	28	34	19	37	17	23	15	25	01	03
	20	16	30	39	26	28	29	16	38	17	10	36	25	16	51	29	34	19	37	17	23	15	25	01	03
	30	16	30	39	-26	28	29	16	38	17	-10	36	25	16	51	29	-34	19	38	17	23	15	-25	01	03
May	10	16	30	40	26	28	30	16	38	17	10	36	25	16	51	29	34	19	39	17	23	16	25	01	03
	20	16	30	40	26	28	31	16	38	17	10	36	24	16	51	29	34	19	40	17	23	16	25	01	04
	30	16	30	40	26	28	31	16	38	17	10	36	24	16	51	30	34	19	41	17	23	16	25	01	04
June	9	16	30	40	26	28	31	16	38	17	10	36	23	16	51	30	34	19	42	17	23	16	25	01	04
	19	16	30	40	26	28	32	16	38	17	10	36	23	16	51	30	34	19	43	17	23	16	25	01	04
	29	16	30	40	-26	28	32	16	38	18	-10	36	22	16	51	30	-34	19	44	17	23	16	-25	01	05
July	9	16	30	40	26	28	33	16	38	18	10	36	22	16	51	30	34	19	44	17	23	16	25	01	05
	19	16	30	40	26	28	33	16	38	17	10	36	21	16	51	30	34	19	45	17	23	16	25	01	05
	29	16	30	40	26	28	33	16	38	17	10	36	21	16	51	30	34	19	46	17	23	16	25	01	06
Aug.	8	16	30	40	26	28	33	16	38	17	10	36	21	16	51	30	34	19	46	17	23	16	25	01	06
	18	16	30	40	26	28	33	16	38	17	10	36	21	16	51	29	34	19	46	17	23	16	25	01	06
	28	16	30	40	-26	28	33	16	38	17	-10	36	20	16	51	29	-34	19	47	17	23	16	-25	01	06
Sept.	7	16	30	39	26	28	33	16	38	17	10	36	20	16	51	29	34	19	47	17	23	16	25	01	06
	17	16	30	39	26	28	33	16	38	17	10	36	20	16	51	29	34	19	47	17	23	16	25	01	06
	27	16	30	39	26	28	33	16	38	17	10	36	20	16	51	29	34	19	46	17	23	16	25	01	06
Oct.	7	16	30	39	26	28	32	16	38	16	10	36	20	16	51	28	34	19	45	17	23	15	25	01	06
	17	16	30	39	26	28	32	16	38	16	10	36	21	16	51	28	34	19	45	17	23	15	25	01	06
	27	16	30	39	-26	28	31	16	38	16	-10	36	21	16	51	28	-34	19	44	17	23	15	-25	01	06
Nov.	6	16	30	39	26	28	31	16	38	16	10	36	21	16	51	28	34	19	43	17	23	15	25	01	05
	16	16	30	39	26	28	30	16	38	16	10	36	22	16	51	28	34	19	43	17	23	15	25	01	05
	26	16	30	39	26	28	30	16	38	16	10	36	23	16	51	28	34	19	42	17	23	15	25	01	05
Dec.	6	16	30	39	26	28	30	16	38	16	10	36	23	16	51	28	34	19	41	17	23	15	25	01	05
	16	16	30	39	26	28	30	16	38	16	10	36	24	16	51	29	34	19	41	17	23	15	25	01	05
	26	16	30	39	-26	28	31	16	38	17	-10	36	26	16	51	29	-34	19	40	17	23	15	-25	01	05
	36	16	30	40	-26	28	31	16	38	17	-10	36	27	16	51	29	-34	19	40	17	23	16	-25	01	05

APPARENT PLACES OF STARS, 2020

FOR 0^h TERRESTRIAL TIME

Name		λ Scorpii						α Ophiuchi						β Ophiuchi						δ Sagittarii					
Mag. Spect.		1.63			B2 IV+			2.08			A5 III			2.77			K2 III			2.70			K3IIIa		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	17	34	55	-37	06	54	17	35	50	+12	32	48	17	44	25	+4	33	38	18	22	14	-29	49	02
	11	17	34	55	37	06	53	17	35	50	12	32	46	17	44	26	4	33	36	18	22	14	29	49	02
	21	17	34	56	37	06	53	17	35	50	12	32	44	17	44	26	4	33	34	18	22	14	29	49	02
	31	17	34	56	37	06	53	17	35	50	12	32	42	17	44	26	4	33	32	18	22	14	29	49	02
Feb.	10	17	34	56	37	06	53	17	35	51	12	32	40	17	44	26	4	33	31	18	22	15	29	49	02
	20	17	34	57	37	06	52	17	35	51	12	32	39	17	44	27	4	33	30	18	22	15	29	49	01
Mar.	1	17	34	57	-37	06	53	17	35	51	+12	32	38	17	44	27	+4	33	29	18	22	15	-29	49	01
	11	17	34	57	37	06	53	17	35	51	12	32	37	17	44	27	4	33	28	18	22	16	29	49	01
	21	17	34	58	37	06	53	17	35	52	12	32	37	17	44	27	4	33	28	18	22	16	29	49	01
	31	17	34	58	37	06	54	17	35	52	12	32	37	17	44	28	4	33	28	18	22	16	29	49	01
Apr.	10	17	34	59	37	06	54	17	35	52	12	32	38	17	44	28	4	33	29	18	22	17	29	49	01
	20	17	34	59	37	06	55	17	35	52	12	32	39	17	44	28	4	33	29	18	22	17	29	49	01
	30	17	34	59	-37	06	55	17	35	53	+12	32	40	17	44	29	+4	33	31	18	22	17	-29	49	01
May	10	17	34	59	37	06	56	17	35	53	12	32	42	17	44	29	4	33	32	18	22	18	29	49	00
	20	17	34	60	37	06	57	17	35	53	12	32	43	17	44	29	4	33	33	18	22	18	29	49	01
	30	17	34	60	37	06	58	17	35	53	12	32	45	17	44	29	4	33	35	18	22	18	29	49	01
June	9	17	35	00	37	06	58	17	35	53	12	32	47	17	44	29	4	33	36	18	22	18	29	49	01
	19	17	35	00	37	07	01	17	35	54	12	32	49	17	44	29	4	33	38	18	22	18	29	49	01
	29	17	35	00	-37	07	00	17	35	54	+12	32	51	17	44	29	+4	33	39	18	22	19	-29	49	02
July	9	17	35	00	37	07	01	17	35	54	12	32	52	17	44	30	4	33	40	18	22	19	29	49	02
	19	17	35	00	37	07	02	17	35	54	12	32	54	17	44	30	4	33	42	18	22	19	29	49	03
	29	17	35	00	37	07	03	17	35	54	12	32	55	17	44	29	4	33	43	18	22	19	29	49	03
Aug.	8	17	35	00	37	07	04	17	35	53	12	32	56	17	44	29	4	33	43	18	22	19	29	49	04
	18	17	35	00	37	07	05	17	35	53	12	32	57	17	44	29	4	33	44	18	22	19	29	49	05
	28	17	34	60	-37	07	05	17	35	53	+12	32	58	17	44	29	+4	33	45	18	22	19	-29	49	05
Sept.	7	17	34	60	37	07	05	17	35	53	12	32	58	17	44	29	4	33	45	18	22	18	29	49	06
	17	17	34	60	37	07	06	17	35	53	12	32	58	17	44	29	4	33	45	18	22	18	29	49	06
	27	17	34	59	37	07	05	17	35	53	12	32	58	17	44	29	4	33	45	18	22	18	29	49	06
Oct.	7	17	34	59	37	07	05	17	35	52	12	32	58	17	44	28	4	33	45	18	22	18	29	49	06
	17	17	34	59	37	07	05	17	35	52	12	32	57	17	44	28	4	33	44	18	22	18	29	49	06
	27	17	34	59	-37	07	04	17	35	52	+12	32	56	17	44	28	+4	33	43	18	22	17	-29	49	06
Nov.	6	17	34	59	37	07	03	17	35	52	12	32	54	17	44	28	4	33	42	18	22	17	29	49	06
	16	17	34	59	37	07	02	17	35	52	12	32	53	17	44	28	4	33	41	18	22	17	29	49	05
	26	17	34	59	37	07	02	17	35	52	12	32	51	17	44	28	4	33	40	18	22	17	29	49	05
Dec.	6	17	34	59	37	07	01	17	35	52	12	32	49	17	44	28	4	33	38	18	22	17	29	49	05
	16	17	34	59	37	07	00	17	35	52	12	32	47	17	44	28	4	33	36	18	22	17	29	49	04
	26	17	34	59	-37	07	01	17	35	52	+12	32	44	17	44	28	+4	33	35	18	22	17	-29	49	04
	36	17	34	59	-37	06	59	17	35	52	+12	32	42	17	44	28	+4	33	33	18	22	18	-29	49	04

APPARENT PLACES OF STARS, 2020

FOR 0^h TERRESTRIAL TIME

Name		ε Sagittarii						σ Sagittarii						ζ Aquilae						γ Aquilae					
Mag. Spect.		1.85			B9.5III			2.02			B2V			2.99			A0 Vn			2.72			G9.5IV		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	18	25	27	-34	22	22	18	56	28	-26	16	14	19	06	17	+13	53	39	19	47	10	+10	39	46
	11	18	25	27	34	22	22	18	56	28	26	16	13	19	06	18	13	53	37	19	47	10	10	39	44
	21	18	25	27	34	22	21	18	56	28	26	16	13	19	06	18	13	53	35	19	47	11	10	39	42
	31	18	25	28	34	22	21	18	56	28	26	16	13	19	06	18	13	53	33	19	47	11	10	39	41
Feb.	10	18	25	28	34	22	20	18	56	28	26	16	13	19	06	18	13	53	31	19	47	11	10	39	39
	20	18	25	28	34	22	20	18	56	29	26	16	12	19	06	18	13	53	30	19	47	11	10	39	38
Mar.	1	18	25	29	-34	22	20	18	56	29	-26	16	12	19	06	19	+13	53	28	19	47	11	+10	39	37
	11	18	25	29	34	22	20	18	56	29	26	16	12	19	06	19	13	53	28	19	47	11	10	39	36
	21	18	25	29	34	22	19	18	56	30	26	16	11	19	06	19	13	53	27	19	47	12	10	39	35
	31	18	25	30	34	22	19	18	56	30	26	16	11	19	06	19	13	53	27	19	47	12	10	39	36
Apr.	10	18	25	30	34	22	19	18	56	30	26	16	11	19	06	20	13	53	28	19	47	12	10	39	36
	20	18	25	30	34	22	19	18	56	31	26	16	10	19	06	20	13	53	29	19	47	13	10	39	37
	30	18	25	31	-34	22	19	18	56	31	-26	16	10	19	06	20	+13	53	30	19	47	13	+10	39	38
May	10	18	25	31	34	22	19	18	56	31	26	16	09	19	06	21	13	53	32	19	47	13	10	39	39
	20	18	25	31	34	22	20	18	56	31	26	16	09	19	06	21	13	53	33	19	47	13	10	39	41
	30	18	25	32	34	22	20	18	56	32	26	16	09	19	06	21	13	53	35	19	47	14	10	39	43
June	9	18	25	32	34	22	20	18	56	32	26	16	08	19	06	21	13	53	37	19	47	14	10	39	45
	19	18	25	32	34	22	21	18	56	32	26	16	08	19	06	21	13	53	40	19	47	14	10	39	47
	29	18	25	32	-34	22	22	18	56	32	-26	16	09	19	06	22	+13	53	42	19	47	14	+10	39	49
July	9	18	25	32	34	22	22	18	56	33	26	16	09	19	06	22	13	53	44	19	47	15	10	39	51
	19	18	25	32	34	22	23	18	56	33	26	16	09	19	06	22	13	53	46	19	47	15	10	39	53
	29	18	25	32	34	22	24	18	56	33	26	16	09	19	06	22	13	53	47	19	47	15	10	39	55
Aug.	8	18	25	32	34	22	25	18	56	33	26	16	10	19	06	22	13	53	49	19	47	15	10	39	56
	18	18	25	32	34	22	26	18	56	33	26	16	10	19	06	22	13	53	50	19	47	15	10	39	58
	28	18	25	32	-34	22	26	18	56	32	-26	16	11	19	06	22	+13	53	52	19	47	15	+10	39	59
Sept.	7	18	25	32	34	22	27	18	56	32	26	16	11	19	06	21	13	53	52	19	47	15	10	39	60
	17	18	25	32	34	22	27	18	56	32	26	16	12	19	06	21	13	53	53	19	47	14	10	40	01
	27	18	25	32	34	22	28	18	56	32	26	16	12	19	06	21	13	53	53	19	47	14	10	40	01
Oct.	7	18	25	31	34	22	28	18	56	32	26	16	12	19	06	21	13	53	53	19	47	14	10	40	01
	17	18	25	31	34	22	28	18	56	32	26	16	13	19	06	21	13	53	53	19	47	14	10	40	01
	27	18	25	31	-34	22	27	18	56	31	-26	16	13	19	06	21	+13	53	52	19	47	14	+10	40	01
Nov.	6	18	25	31	34	22	27	18	56	31	26	16	13	19	06	20	13	53	51	19	47	14	10	40	00
	16	18	25	31	34	22	26	18	56	31	26	16	13	19	06	20	13	53	50	19	47	13	10	39	59
	26	18	25	31	34	22	26	18	56	31	26	16	13	19	06	20	13	53	49	19	47	13	10	39	58
Dec.	6	18	25	31	34	22	25	18	56	31	26	16	12	19	06	20	13	53	47	19	47	13	10	39	57
	16	18	25	31	34	22	24	18	56	31	26	16	12	19	06	20	13	53	45	19	47	13	10	39	55
	26	18	25	31	-34	22	24	18	56	31	-26	16	12	19	06	20	+13	53	43	19	47	13	+10	39	53
	36	18	25	31	-34	22	23	18	56	31	-26	16	12	19	06	20	+13	53	41	19	47	13	+10	39	51

APPARENT PLACES OF STARS, 2020

FOR 0^h TERRESTRIAL TIME

Name		α Aquilae						γ Cygni						α Cygni						β Aquarii					
Mag. Spect.		0.77			A7 V			2.20			F8 I ab			1.25			A2 Iae			2.91			A1.5V		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	19	51	43	+8	55	19	20	22	55	+40	19	20	20	42	05	+45	21	13	21	32	35	-5	29	02
	11	19	51	43	8	55	17	20	22	55	40	19	17	20	42	05	45	21	10	21	32	35	5	29	03
	21	19	51	43	8	55	15	20	22	55	40	19	14	20	42	05	45	21	07	21	32	35	5	29	04
	31	19	51	44	8	55	14	20	22	55	40	19	11	20	42	05	45	21	04	21	32	35	5	29	04
Feb.	10	19	51	44	8	55	12	20	22	55	40	19	08	20	42	05	45	21	01	21	32	35	5	29	04
	20	19	51	44	8	55	11	20	22	55	40	19	06	20	42	05	45	20	58	21	32	35	5	29	05
Mar.	1	19	51	44	+8	55	10	20	22	55	+40	19	03	20	42	05	+45	20	55	21	32	35	-5	29	05
	11	19	51	44	8	55	09	20	22	55	40	19	01	20	42	05	45	20	53	21	32	35	5	29	05
	21	19	51	45	8	55	09	20	22	56	40	19	00	20	42	06	45	20	52	21	32	35	5	29	04
	31	19	51	45	8	55	09	20	22	56	40	18	59	20	42	06	45	20	51	21	32	35	5	29	04
Apr.	10	19	51	45	8	55	10	20	22	56	40	18	59	20	42	06	45	20	50	21	32	36	5	29	03
	20	19	51	46	8	55	10	20	22	57	40	18	59	20	42	07	45	20	50	21	32	36	5	29	02
	30	19	51	46	+8	55	12	20	22	57	+40	19	00	20	42	07	+45	20	51	21	32	36	-5	29	00
May	10	19	51	46	8	55	13	20	22	57	40	19	02	20	42	07	45	20	52	21	32	37	5	28	59
	20	19	51	46	8	55	15	20	22	58	40	19	03	20	42	08	45	20	54	21	32	37	5	28	57
	30	19	51	47	8	55	17	20	22	58	40	19	06	20	42	08	45	20	56	21	32	37	5	28	55
June	9	19	51	47	8	55	19	20	22	58	40	19	08	20	42	08	45	20	59	21	32	38	5	28	53
	19	19	51	47	8	55	21	20	22	59	40	19	11	20	42	09	45	21	01	21	32	38	5	28	52
	29	19	51	47	+8	55	23	20	22	59	+40	19	14	20	42	09	+45	21	04	21	32	38	-5	28	50
July	9	19	51	47	8	55	25	20	22	59	40	19	18	20	42	09	45	21	08	21	32	38	5	28	48
	19	19	51	48	8	55	27	20	22	59	40	19	21	20	42	09	45	21	11	21	32	39	5	28	47
	29	19	51	48	8	55	28	20	22	59	40	19	24	20	42	09	45	21	14	21	32	39	5	28	46
Aug.	8	19	51	48	8	55	30	20	22	59	40	19	27	20	42	09	45	21	17	21	32	39	5	28	45
	18	19	51	48	8	55	31	20	22	59	40	19	30	20	42	09	45	21	21	21	32	39	5	28	44
	28	19	51	48	+8	55	32	20	22	59	+40	19	32	20	42	09	+45	21	23	21	32	39	-5	28	44
Sept.	7	19	51	47	8	55	33	20	22	59	40	19	34	20	42	09	45	21	26	21	32	39	5	28	43
	17	19	51	47	8	55	34	20	22	59	40	19	36	20	42	09	45	21	28	21	32	39	5	28	43
	27	19	51	47	8	55	34	20	22	58	40	19	38	20	42	09	45	21	30	21	32	39	5	28	43
Oct.	7	19	51	47	8	55	34	20	22	58	40	19	39	20	42	08	45	21	31	21	32	39	5	28	43
	17	19	51	47	8	55	34	20	22	58	40	19	39	20	42	08	45	21	32	21	32	39	5	28	44
	27	19	51	47	+8	55	34	20	22	58	+40	19	39	20	42	08	+45	21	33	21	32	38	-5	28	44
Nov.	6	19	51	47	8	55	33	20	22	57	40	19	39	20	42	08	45	21	33	21	32	38	5	28	44
	16	19	51	46	8	55	32	20	22	57	40	19	38	20	42	07	45	21	32	21	32	38	5	28	45
	26	19	51	46	8	55	31	20	22	57	40	19	37	20	42	07	45	21	31	21	32	38	5	28	46
Dec.	6	19	51	46	8	55	30	20	22	57	40	19	35	20	42	07	45	21	29	21	32	38	5	28	46
	16	19	51	46	8	55	28	20	22	57	40	19	33	20	42	07	45	21	28	21	32	38	5	28	47
	26	19	51	46	+8	55	27	20	22	57	+40	19	31	20	42	07	+45	21	25	21	32	38	-5	28	48
	36	19	51	46	+8	55	25	20	22	57	+40	19	28	20	42	06	+45	21	22	21	32	38	-5	28	48

APPARENT PLACES OF STARS, 2020

FOR 0^h TERRESTRIAL TIME

Name		ε Pegasi						α Aquarii						δ Aquarii						α Pegasi					
Mag. Spect.		0.7 - 3.5			K2 Ib			2.96			G2 Ib			3.27			A3 V			2.49			B9III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	21	45	08	+9	57	60	22	06	47	-0	13	25	22	55	41	-15	43	02	23	05	44	+15	18	45
	11	21	45	08	9	57	58	22	06	47	0	13	26	22	55	41	15	43	02	23	05	44	15	18	44
	21	21	45	08	9	57	57	22	06	47	0	13	26	22	55	41	15	43	02	23	05	44	15	18	43
	31	21	45	08	9	57	56	22	06	47	0	13	27	22	55	41	15	43	02	23	05	44	15	18	41
Feb.	10	21	45	08	9	57	54	22	06	47	0	13	28	22	55	41	15	43	02	23	05	44	15	18	40
	20	21	45	08	9	57	53	22	06	47	0	13	28	22	55	41	15	43	01	23	05	44	15	18	39
Mar.	1	21	45	08	+9	57	52	22	06	47	-0	13	29	22	55	41	-15	43	01	23	05	44	+15	18	38
	11	21	45	09	9	57	51	22	06	47	0	13	29	22	55	41	15	43	00	23	05	44	15	18	37
	21	21	45	09	9	57	51	22	06	47	0	13	28	22	55	41	15	42	58	23	05	44	15	18	36
	31	21	45	09	9	57	51	22	06	47	0	13	28	22	55	41	15	42	57	23	05	44	15	18	36
Apr.	10	21	45	09	9	57	51	22	06	48	0	13	27	22	55	41	15	42	56	23	05	44	15	18	36
	20	21	45	09	9	57	52	22	06	48	0	13	26	22	55	42	15	42	54	23	05	44	15	18	36
	30	21	45	10	+9	57	53	22	06	48	-0	13	25	22	55	42	-15	42	52	23	05	45	+15	18	37
May	10	21	45	10	9	57	54	22	06	48	0	13	23	22	55	42	15	42	50	23	05	45	15	18	38
	20	21	45	10	9	57	56	22	06	49	0	13	22	22	55	42	15	42	48	23	05	45	15	18	39
	30	21	45	11	9	57	58	22	06	49	0	13	20	22	55	43	15	42	46	23	05	46	15	18	41
June	9	21	45	11	9	58	00	22	06	49	0	13	18	22	55	43	15	42	44	23	05	46	15	18	43
	19	21	45	11	9	58	02	22	06	50	0	13	16	22	55	43	15	42	42	23	05	46	15	18	45
	29	21	45	11	+9	58	04	22	06	50	-0	13	14	22	55	44	-15	42	41	23	05	47	+15	18	47
July	9	21	45	12	9	58	07	22	06	50	0	13	12	22	55	44	15	42	39	23	05	47	15	18	49
	19	21	45	12	9	58	09	22	06	50	0	13	11	22	55	44	15	42	38	23	05	47	15	18	51
	29	21	45	12	9	58	11	22	06	51	0	13	09	22	55	44	15	42	37	23	05	47	15	18	54
Aug.	8	21	45	12	9	58	12	22	06	51	0	13	08	22	55	45	15	42	36	23	05	48	15	18	56
	18	21	45	12	9	58	14	22	06	51	0	13	06	22	55	45	15	42	36	23	05	48	15	18	58
	28	21	45	12	+9	58	16	22	06	51	-0	13	05	22	55	45	-15	42	36	23	05	48	+15	18	60
Sept.	7	21	45	12	9	58	17	22	06	51	0	13	05	22	55	45	15	42	36	23	05	48	15	19	01
	17	21	45	12	9	58	18	22	06	51	0	13	04	22	55	45	15	42	36	23	05	48	15	19	03
	27	21	45	12	9	58	19	22	06	51	0	13	04	22	55	45	15	42	37	23	05	48	15	19	04
Oct.	7	21	45	12	9	58	19	22	06	51	0	13	04	22	55	45	15	42	37	23	05	48	15	19	05
	17	21	45	12	9	58	19	22	06	51	0	13	04	22	55	45	15	42	38	23	05	48	15	19	06
	27	21	45	12	+9	58	20	22	06	51	-0	13	04	22	55	45	-15	42	39	23	05	48	+15	19	07
Nov.	6	21	45	12	9	58	19	22	06	50	0	13	05	22	55	45	15	42	40	23	05	48	15	19	07
	16	21	45	12	9	58	19	22	06	50	0	13	05	22	55	45	15	42	41	23	05	48	15	19	07
	26	21	45	11	9	58	18	22	06	50	0	13	06	22	55	45	15	42	42	23	05	47	15	19	07
Dec.	6	21	45	11	9	58	18	22	06	50	0	13	06	22	55	44	15	42	42	23	05	47	15	19	06
	16	21	45	11	9	58	17	22	06	50	0	13	07	22	55	44	15	42	43	23	05	47	15	19	06
	26	21	45	11	+9	58	15	22	06	50	-0	13	08	22	55	44	-15	42	43	23	05	47	+15	19	04
	36	21	45	11	+9	58	14	22	06	50	-0	13	09	22	55	44	-15	42	44	23	05	47	+15	19	03

BESSELIAN DAY NUMBERS, 2020.5

FOR 0^h TERRESTRIAL TIME

Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
Jan.	0	-0.5041	-16.652	+1.752	-3.025	+20.591	-21	+0.212	+0.042
	1	0.5014	16.608	1.707	3.355	20.529	21	0.140	0.071
	2	0.4986	16.573	1.674	3.684	20.460	22	+0.046	0.088
	3	0.4959	16.541	1.656	4.012	20.386	22	-0.058	0.089
	4	0.4932	16.508	1.653	4.338	20.304	22	0.155	0.075
	5	0.4904	16.466	1.663	4.662	20.217	22	0.232	+0.047
	6	-0.4877	-16.412	+1.683	-4.985	+20.124	-22	-0.274	+0.008
	7	0.4849	16.340	1.706	5.306	20.024	22	0.272	0.035
	8	0.4822	16.250	1.725	5.625	19.919	22	0.224	0.074
	9	0.4795	16.143	1.730	5.942	19.808	21	0.134	0.100
	10	0.4767	16.027	1.716	6.257	19.691	21	-0.018	0.106
	11	0.4740	15.911	1.677	6.570	19.569	21	+0.098	0.089
	12	-0.4713	-15.807	+1.616	-6.881	+19.441	-21	+0.187	-0.051
	13	0.4685	15.723	1.542	7.190	19.307	21	0.225	-0.000
	14	0.4658	15.663	1.468	7.497	19.168	21	0.203	+0.051
	15	0.4630	15.625	1.406	7.803	19.023	21	0.129	0.089
	16	0.4603	15.598	1.365	8.106	18.873	21	+0.026	0.105
	17	0.4576	15.573	1.350	8.408	18.716	21	-0.076	0.096
	18	-0.4548	-15.536	+1.355	-8.707	+18.553	-21	-0.152	+0.065
	19	0.4521	15.483	1.374	9.004	18.385	21	0.183	+0.021
	20	0.4493	15.410	1.394	9.298	18.210	21	0.163	-0.025
	21	0.4466	15.320	1.406	9.589	18.029	21	0.099	0.064
	22	0.4439	15.220	1.402	9.878	17.843	21	-0.008	0.087
	23	0.4411	15.117	1.378	10.163	17.650	21	+0.092	0.090
	24	-0.4384	-15.020	+1.335	-10.445	+17.452	-20	+0.178	-0.075
	25	0.4357	14.935	1.278	10.723	17.247	20	0.235	0.045
	26	0.4329	14.867	1.212	10.998	17.038	20	0.252	-0.008
	27	0.4302	14.816	1.146	11.269	16.822	20	0.227	+0.030
	28	0.4274	14.780	1.085	11.536	16.602	20	0.165	0.063
	29	0.4247	14.756	1.036	11.799	16.376	20	+0.077	0.083
	30	-0.4220	-14.738	+1.001	-12.058	+16.145	-21	-0.025	+0.090
	31	0.4192	14.720	0.981	12.312	15.910	21	0.127	0.081
Feb.	1	0.4165	14.696	0.976	12.563	15.670	21	0.212	0.057
	2	0.4138	14.662	0.982	12.809	15.425	21	0.268	+0.022
	3	0.4110	14.612	0.994	13.051	15.175	21	0.285	-0.019
	4	0.4083	14.546	1.005	13.288	14.922	21	0.258	0.060
	5	-0.4055	-14.463	+1.008	-13.521	+14.664	-21	-0.187	-0.092
	6	0.4028	14.367	0.995	13.750	14.402	21	-0.082	0.108
	7	0.4001	14.266	0.959	13.974	14.137	20	+0.037	0.101
	8	0.3973	14.171	0.900	14.194	13.867	20	0.143	0.071
	9	0.3946	14.093	0.823	14.410	13.594	20	0.208	-0.022
	10	0.3919	14.039	0.739	14.622	13.318	20	0.214	+0.033
	11	-0.3891	-14.010	+0.664	-14.829	+13.038	-20	+0.158	+0.080
	12	0.3864	13.998	0.610	15.032	12.754	20	+0.062	0.105
	13	0.3836	13.991	0.583	15.231	12.466	21	-0.045	0.104
	14	0.3809	13.976	0.582	15.426	12.175	21	0.130	0.077
	15	-0.3782	-13.944	+0.598	-15.616	+11.879	-21	-0.171	+0.034

BESSELIAN DAY NUMBERS, 2020.5

FOR 0^h TERRESTRIAL TIME

Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
Feb.	15	-0.3782	-13.944	+0.598	-15.616	+11.879	-21	-0.171	+0.034
	16	0.3754	13.891	0.618	15.802	11.580	21	0.160	-0.014
	17	0.3727	13.821	0.633	15.983	11.277	21	0.103	0.055
	18	0.3700	13.740	0.633	16.159	10.970	21	-0.015	0.082
	19	0.3672	13.655	0.614	16.330	10.660	21	+0.083	0.090
	20	0.3645	13.574	0.578	16.495	10.346	20	0.172	0.079
	21	-0.3617	-13.504	+0.526	-16.656	+10.028	-20	+0.235	-0.053
	22	0.3590	13.450	0.465	16.811	9.708	20	0.261	-0.017
	23	0.3563	13.412	0.402	16.960	9.385	20	0.246	+0.021
	24	0.3535	13.390	0.344	17.104	9.058	21	0.193	0.055
	25	0.3508	13.380	0.296	17.242	8.730	21	0.110	0.080
	26	0.3480	13.377	0.262	17.374	8.398	21	+0.009	0.090
	27	-0.3453	-13.377	+0.244	-17.501	+8.065	-21	-0.094	+0.085
	28	0.3426	13.372	0.242	17.622	7.729	21	0.185	0.066
	29	0.3398	13.357	0.252	17.737	7.391	21	0.252	+0.034
Mar.	1	0.3371	13.329	0.270	17.847	7.051	21	0.283	-0.006
	2	0.3344	13.285	0.290	17.950	6.710	22	0.273	0.046
	3	0.3316	13.225	0.305	18.048	6.367	22	0.221	0.081
	4	-0.3289	-13.150	+0.308	-18.141	+6.023	-21	-0.134	-0.103
	5	0.3261	13.068	0.292	18.227	5.678	21	-0.026	0.106
	6	0.3234	12.986	0.255	18.309	5.332	21	+0.083	0.087
	7	0.3207	12.914	0.196	18.384	4.985	21	0.167	-0.046
	8	0.3179	12.863	0.126	18.455	4.638	21	0.200	+0.008
	9	0.3152	12.836	0.056	18.520	4.289	21	0.171	0.062
	10	-0.3125	-12.831	+0.003	-18.580	+3.940	-21	+0.089	+0.099
	11	0.3097	12.837	-0.022	18.635	3.590	22	-0.019	0.110
	12	0.3070	12.838	-0.018	18.684	3.239	22	0.117	0.091
	13	0.3042	12.824	+0.009	18.729	2.887	22	0.173	0.051
	14	0.3015	12.787	0.046	18.768	2.534	22	0.174	+0.000
	15	0.2988	12.729	0.080	18.802	2.180	22	0.121	-0.046
	16	-0.2960	-12.657	+0.101	-18.830	+1.826	-22	-0.032	-0.077
	17	0.2933	12.579	0.102	18.852	1.470	22	+0.072	0.090
	18	0.2906	12.503	0.085	18.869	1.114	22	0.169	0.083
	19	0.2878	12.438	0.052	18.880	0.758	22	0.240	0.059
	20	0.2851	12.388	+0.009	18.885	0.402	22	0.275	-0.025
	21	0.2823	12.354	-0.037	18.884	+0.045	22	0.269	+0.014
	22	-0.2796	-12.335	-0.080	-18.877	-0.312	-22	+0.223	+0.050
	23	0.2769	12.329	0.114	18.864	0.668	22	0.146	0.076
	24	0.2741	12.332	0.133	18.846	1.024	22	+0.047	0.091
	25	0.2714	12.336	0.137	18.821	1.379	23	-0.057	0.089
	26	0.2687	12.338	0.126	18.790	1.734	23	0.154	0.073
	27	0.2659	12.330	0.100	18.754	2.087	23	0.228	0.044
	28	-0.2632	-12.310	-0.066	-18.711	-2.440	-23	-0.270	+0.006
	29	0.2604	12.273	0.027	18.663	2.791	23	0.272	-0.035
	30	0.2577	12.220	0.007	18.610	3.140	23	0.234	0.071
	31	0.2550	12.153	0.032	18.550	3.489	23	0.160	0.097
Apr.	1	-0.2522	-12.076	-0.040	-18.485	-3.835	-23	-0.063	-0.106

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Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
Apr.	1	-0.2522	-12.076	-0.040	-18.485	-3.835	-23	-0.063	-0.106
	2	0.2495	11.997	0.029	18.415	4.179	23	+0.039	0.095
	3	0.2467	11.924	0.002	18.339	4.522	23	0.126	0.063
	4	0.2440	11.865	0.049	18.258	4.862	23	0.175	-0.015
	5	0.2413	11.828	0.101	18.173	5.200	23	0.170	+0.038
	6	0.2385	11.813	0.144	18.082	5.537	23	0.109	0.084
	7	-0.2358	-11.813	-0.165	-17.986	-5.871	-23	+0.008	+0.108
	8	0.2331	11.816	0.156	17.886	6.203	23	-0.100	0.103
	9	0.2303	11.807	0.119	17.782	6.533	24	0.179	0.070
	10	0.2276	11.775	0.065	17.672	6.861	24	0.202	+0.020
	11	0.2248	11.718	-0.009	17.558	7.187	24	0.163	-0.032
	12	0.2221	11.641	+0.037	17.439	7.512	24	-0.076	0.072
	13	-0.2194	-11.554	+0.062	-17.315	-7.834	-23	+0.036	-0.091
	14	0.2166	11.467	0.066	17.186	8.155	23	0.147	0.089
	15	0.2139	11.390	0.052	17.051	8.473	23	0.234	0.068
	16	0.2112	11.326	+0.026	16.912	8.788	23	0.283	-0.035
	17	0.2084	11.280	-0.006	16.768	9.102	23	0.289	+0.005
	18	0.2057	11.249	0.036	16.618	9.412	23	0.253	0.042
	19	-0.2029	-11.232	-0.058	-16.464	-9.720	-23	+0.182	+0.073
	20	0.2002	11.224	0.067	16.304	10.024	24	+0.086	0.090
	21	0.1975	11.220	0.061	16.140	10.326	24	-0.019	0.093
	22	0.1947	11.213	0.039	15.970	10.624	24	0.120	0.080
	23	0.1920	11.198	-0.003	15.796	10.918	24	0.201	0.054
	24	0.1893	11.171	+0.043	15.617	11.209	24	0.252	+0.017
	25	-0.1865	-11.127	+0.094	-15.433	-11.497	-24	-0.264	-0.024
	26	0.1838	11.066	0.142	15.245	11.780	24	0.235	0.062
	27	0.1810	10.991	0.182	15.053	12.059	24	0.170	0.091
	28	0.1783	10.904	0.205	14.856	12.335	24	-0.079	0.105
	29	0.1756	10.814	0.210	14.655	12.606	24	+0.020	0.099
	30	0.1728	10.728	0.195	14.450	12.873	24	0.107	0.073
May	1	-0.1701	-10.654	+0.164	-14.241	-13.135	-24	+0.162	-0.031
	2	0.1674	10.599	0.124	14.028	13.393	24	0.171	+0.019
	3	0.1646	10.563	0.087	13.812	13.647	24	0.126	0.067
	4	0.1619	10.545	0.066	13.593	13.896	24	+0.036	0.099
	5	0.1591	10.535	0.070	13.370	14.141	24	-0.073	0.106
	6	0.1564	10.518	0.102	13.144	14.382	24	0.170	0.085
	7	-0.1537	-10.483	+0.156	-12.915	-14.619	-24	-0.221	+0.041
	8	0.1509	10.423	0.220	12.683	14.852	24	0.209	-0.012
	9	0.1482	10.337	0.279	12.448	15.081	24	0.137	0.060
	10	0.1454	10.236	0.319	12.209	15.306	24	-0.026	0.090
	11	0.1427	10.129	0.336	11.967	15.526	24	+0.097	0.096
	12	0.1400	10.029	0.331	11.721	15.743	24	0.203	0.081
	13	-0.1372	-9.942	+0.309	-11.472	-15.956	-24	+0.273	-0.049
	14	0.1345	9.873	0.278	11.220	16.164	24	0.297	-0.009
	15	0.1318	9.822	0.248	10.964	16.367	24	0.275	+0.032
	16	0.1290	9.786	0.223	10.705	16.566	24	0.213	0.066
	17	-0.1263	-9.761	+0.210	-10.443	-16.760	-24	+0.123	+0.088

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Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
May	17	-0.1263	-9.761	+0.210	-10.443	-16.760	-24	+0.123	+0.088
	18	0.1235	9.741	0.211	10.178	16.949	24	+0.019	0.096
	19	0.1208	9.720	0.228	9.910	17.133	24	-0.085	0.087
	20	0.1181	9.693	0.260	9.638	17.313	24	0.174	0.064
	21	0.1153	9.654	0.303	9.364	17.486	24	0.234	+0.029
	22	0.1126	9.599	0.351	9.087	17.655	24	0.257	-0.012
	23	-0.1099	-9.527	+0.399	-8.807	-17.818	-24	-0.237	-0.052
	24	0.1071	9.439	0.438	8.525	17.976	24	0.179	0.085
	25	0.1044	9.339	0.463	8.240	18.128	24	-0.091	0.103
	26	0.1016	9.234	0.468	7.954	18.274	24	+0.010	0.102
	27	0.0989	9.132	0.452	7.665	18.415	23	0.101	0.081
	28	0.0962	9.040	0.419	7.374	18.550	23	0.164	-0.042
	29	-0.0934	-8.967	+0.375	-7.082	-18.679	-23	+0.182	+0.006
	30	0.0907	8.913	0.332	6.788	18.802	23	0.148	0.054
	31	0.0880	8.877	0.300	6.492	18.920	23	+0.069	0.090
June	1	0.0852	8.852	0.288	6.196	19.032	23	-0.038	0.105
	2	0.0825	8.826	0.303	5.898	19.139	24	0.143	0.093
	3	0.0797	8.786	0.340	5.600	19.241	24	0.215	0.058
	4	-0.0770	-8.724	+0.392	-5.300	-19.337	-24	-0.232	+0.008
	5	0.0743	8.637	0.444	4.999	19.428	23	0.187	-0.043
	6	0.0715	8.529	0.484	4.697	19.515	23	-0.091	0.082
	7	0.0688	8.411	0.501	4.394	19.596	23	+0.032	0.099
	8	0.0661	8.294	0.493	4.090	19.672	23	0.151	0.092
	9	0.0633	8.188	0.465	3.784	19.743	23	0.242	0.065
	10	-0.0606	-8.100	+0.424	-3.477	-19.809	-23	+0.287	-0.026
	11	0.0578	8.030	0.379	3.169	19.869	22	0.284	+0.017
	12	0.0551	7.979	0.338	2.860	19.924	23	0.237	0.056
	13	0.0524	7.941	0.307	2.550	19.974	23	0.155	0.083
	14	0.0496	7.910	0.290	2.239	20.017	23	+0.053	0.096
	15	0.0469	7.881	0.288	1.927	20.055	23	-0.053	0.093
	16	-0.0441	-7.848	+0.302	-1.614	-20.088	-23	-0.148	+0.073
	17	0.0414	7.805	0.328	1.301	20.114	23	0.218	0.041
	18	0.0387	7.747	0.362	0.987	20.135	23	0.253	+0.001
	19	0.0359	7.673	0.397	0.673	20.150	23	0.245	-0.041
	20	0.0332	7.582	0.425	0.358	20.158	23	0.196	0.077
	21	0.0305	7.478	0.440	-0.043	20.161	22	0.113	0.100
	22	-0.0277	-7.365	+0.435	+0.272	-20.157	-22	-0.010	-0.105
	23	0.0250	7.254	0.409	0.587	20.148	22	+0.090	0.088
	24	0.0222	7.153	0.364	0.901	20.132	22	0.166	0.053
	25	0.0195	7.069	0.305	1.215	20.110	22	0.197	-0.005
	26	0.0168	7.007	0.244	1.528	20.082	22	0.175	+0.044
	27	0.0140	6.964	0.192	1.840	20.048	22	0.105	0.084
	28	-0.0113	-6.934	+0.160	+2.151	-20.009	-22	+0.002	+0.104
	29	0.0086	6.906	0.151	2.461	19.964	22	-0.106	0.098
	30	0.0058	6.869	0.166	2.770	19.913	22	0.191	0.069
July	1	0.0031	6.814	0.197	3.077	19.857	22	0.228	+0.024
	2	-0.0003	-6.735	+0.233	+3.384	-19.796	-22	-0.207	-0.027

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			"	"	"	"	s (0.0001)		
July	1	-0.0031	-6.814	+0.197	+3.077	-19.857	-22	-0.228	+0.024
	2	-0.0003	6.735	0.233	3.384	19.796	22	0.207	-0.027
	3	+0.0024	6.635	0.260	3.689	19.730	22	0.132	0.070
	4	0.0051	6.521	0.269	3.993	19.658	22	-0.021	0.095
	5	0.0079	6.404	0.254	4.296	19.582	21	+0.100	0.098
	6	0.0106	6.294	0.217	4.598	19.500	21	0.202	0.078
	7	+0.0133	-6.199	+0.164	+4.899	-19.414	-21	+0.266	-0.042
	8	0.0161	6.124	0.102	5.199	19.322	21	0.283	+0.001
	9	0.0188	6.068	+0.041	5.498	19.225	21	0.251	0.042
	10	0.0216	6.028	-0.010	5.795	19.123	21	0.180	0.075
	11	0.0243	5.999	0.049	6.091	19.015	21	+0.084	0.093
	12	0.0270	5.974	0.072	6.386	18.903	21	-0.023	0.095
	13	+0.0298	-5.947	-0.079	+6.680	-18.784	-21	-0.123	+0.081
	14	0.0325	5.912	0.072	6.972	18.660	21	0.203	0.053
	15	0.0352	5.864	0.056	7.262	18.531	21	0.250	+0.015
	16	0.0380	5.801	0.036	7.550	18.397	21	0.257	-0.027
	17	0.0407	5.722	0.020	7.837	18.256	21	0.222	0.066
	18	0.0435	5.627	0.014	8.121	18.111	21	0.148	0.095
	19	+0.0462	-5.523	-0.027	+8.404	-17.959	-21	-0.048	-0.106
	20	0.0489	5.416	0.060	8.684	17.803	21	+0.059	0.097
	21	0.0517	5.317	0.115	8.962	17.640	21	0.150	0.066
	22	0.0544	5.233	0.186	9.236	17.472	21	0.200	-0.020
	23	0.0572	5.172	0.263	9.509	17.299	21	0.196	+0.032
	24	0.0599	5.133	0.333	9.778	17.121	21	0.139	0.077
	25	+0.0626	-5.110	-0.384	+10.043	-16.937	-21	+0.041	+0.103
	26	0.0654	5.092	0.411	10.306	16.749	21	-0.068	0.104
	27	0.0681	5.068	0.413	10.565	16.556	21	0.160	0.080
	28	0.0708	5.028	0.397	10.821	16.359	21	0.210	+0.037
	29	0.0736	4.966	0.373	11.074	16.157	21	0.205	-0.013
	30	0.0763	4.884	0.354	11.323	15.951	21	0.146	0.058
	31	+0.0791	-4.786	-0.351	+11.569	-15.741	-21	-0.047	-0.089
Aug.	1	0.0818	4.682	0.369	11.812	15.527	21	+0.067	0.098
	2	0.0845	4.583	0.409	12.052	15.309	21	0.173	0.085
	3	0.0873	4.496	0.467	12.289	15.087	20	0.248	0.054
	4	0.0900	4.427	0.535	12.523	14.860	20	0.279	-0.013
	5	0.0927	4.378	0.605	12.753	14.630	20	0.262	+0.029
	6	+0.0955	-4.347	-0.668	+12.980	-14.396	-20	+0.203	+0.065
	7	0.0982	4.328	0.719	13.204	14.158	21	0.113	0.089
	8	0.1010	4.315	0.754	13.425	13.915	21	+0.008	0.096
	9	0.1037	4.303	0.772	13.642	13.669	21	-0.096	0.087
	10	0.1064	4.285	0.776	13.856	13.418	21	0.184	0.063
	11	0.1092	4.257	0.768	14.066	13.163	21	0.244	+0.028
	12	+0.1119	-4.214	-0.754	+14.273	-12.904	-21	-0.266	-0.013
	13	0.1146	4.154	0.740	14.476	12.641	21	0.246	0.054
	14	0.1174	4.080	0.734	14.675	12.374	21	0.187	0.087
	15	0.1201	3.994	0.743	14.870	12.103	21	-0.096	0.105
	16	+0.1229	-3.902	-0.771	+15.061	-11.828	-21	+0.010	-0.104

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Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
Aug.	16	+0.1229	-3.902	-0.771	+15.061	-11.828	-21	+0.010	-0.104
	17	0.1256	3.813	0.821	15.248	11.549	21	0.110	0.081
	18	0.1283	3.737	0.889	15.430	11.266	21	0.180	-0.038
	19	0.1311	3.681	0.968	15.608	10.979	21	0.200	+0.014
	20	0.1338	3.648	1.044	15.781	10.688	21	0.162	0.065
	21	0.1366	3.636	1.104	15.949	10.394	21	+0.075	0.099
	22	+0.1393	-3.633	-1.139	+16.112	-10.097	-21	-0.034	+0.109
	23	0.1420	3.626	1.146	16.271	9.797	21	0.134	0.091
	24	0.1448	3.605	1.130	16.424	9.494	21	0.195	+0.050
	25	0.1475	3.562	1.104	16.572	9.189	21	0.201	-0.000
	26	0.1502	3.498	1.080	16.715	8.881	21	0.151	0.048
	27	0.1530	3.417	1.069	16.854	8.571	21	-0.059	0.082
	28	+0.1557	-3.329	-1.078	+16.987	-8.259	-21	+0.053	-0.096
	29	0.1585	3.243	1.109	17.116	7.944	21	0.160	0.089
	30	0.1612	3.168	1.157	17.240	7.628	21	0.241	0.062
	31	0.1639	3.109	1.218	17.360	7.309	21	0.282	-0.024
Sept.	1	0.1667	3.069	1.282	17.475	6.988	21	0.277	+0.019
	2	0.1694	3.047	1.341	17.586	6.666	21	0.227	0.057
	3	+0.1721	-3.039	-1.388	+17.691	-6.341	-21	+0.144	+0.084
	4	0.1749	3.039	1.420	17.792	6.014	21	+0.041	0.096
	5	0.1776	3.041	1.435	17.889	5.685	22	-0.065	0.092
	6	0.1804	3.038	1.434	17.980	5.355	22	0.160	0.072
	7	0.1831	3.026	1.420	18.067	5.022	22	0.230	+0.039
	8	0.1858	3.000	1.398	18.149	4.687	22	0.265	-0.000
	9	+0.1886	-2.959	-1.375	+18.226	-4.351	-22	-0.260	-0.041
	10	0.1913	2.902	1.356	18.298	4.013	22	0.216	0.077
	11	0.1940	2.833	1.348	18.364	3.673	22	0.139	0.100
	12	0.1968	2.755	1.357	18.426	3.331	22	-0.041	0.107
	13	0.1995	2.677	1.386	18.482	2.987	22	+0.059	0.092
	14	0.2023	2.606	1.435	18.533	2.642	22	0.141	0.058
	15	+0.2050	-2.551	-1.498	+18.578	-2.296	-22	+0.182	-0.009
	16	0.2077	2.519	1.564	18.617	1.948	22	0.169	+0.045
	17	0.2105	2.508	1.620	18.651	1.599	22	+0.100	0.089
	18	0.2132	2.512	1.653	18.678	1.249	22	-0.005	0.110
	19	0.2159	2.517	1.656	18.700	0.898	22	0.114	0.102
	20	0.2187	2.510	1.631	18.716	0.547	23	0.190	0.067
	21	+0.2214	-2.481	-1.590	+18.726	-0.196	-23	-0.211	+0.016
	22	0.2242	2.426	1.547	18.730	+0.155	23	0.169	-0.036
	23	0.2269	2.353	1.515	18.728	0.505	23	-0.079	0.076
	24	0.2296	2.269	1.503	18.721	0.856	22	+0.037	0.096
	25	0.2324	2.186	1.514	18.709	1.206	22	0.151	0.092
	26	0.2351	2.112	1.543	18.691	1.555	22	0.242	0.069
	27	+0.2379	-2.054	-1.585	+18.668	+1.904	-22	+0.292	-0.033
	28	0.2406	2.014	1.633	18.639	2.252	22	0.297	+0.010
	29	0.2433	1.992	1.677	18.606	2.600	22	0.256	0.049
	30	0.2461	1.985	1.711	18.567	2.947	23	0.180	0.080
Oct.	1	+0.2488	-1.986	-1.730	+18.523	+3.294	-23	+0.079	+0.096

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Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
Oct.	1	+0.2488	-1.986	-1.730	+18.523	+3.294	-23	+0.079	+0.096
	2	0.2515	1.991	1.732	18.474	3.640	23	-0.029	0.096
	3	0.2543	1.992	1.718	18.420	3.985	23	0.129	0.080
	4	0.2570	1.984	1.689	18.361	4.330	23	0.207	0.050
	5	0.2598	1.962	1.651	18.296	4.673	23	0.253	+0.012
	6	0.2625	1.926	1.610	18.226	5.016	24	0.260	-0.029
	7	+0.2652	-1.873	-1.572	+18.151	+5.358	-24	-0.229	-0.067
	8	0.2680	1.807	1.543	18.070	5.699	24	0.164	0.094
	9	0.2707	1.732	1.529	17.985	6.039	23	-0.076	0.106
	10	0.2734	1.653	1.534	17.893	6.378	23	+0.019	0.099
	11	0.2762	1.579	1.557	17.797	6.716	23	0.103	0.073
	12	0.2789	1.516	1.596	17.694	7.052	23	0.156	-0.030
	13	+0.2817	-1.472	-1.644	+17.586	+7.387	-23	+0.162	+0.022
	14	0.2844	1.448	1.688	17.473	7.721	23	0.115	0.071
	15	0.2871	1.442	1.715	17.353	8.052	24	+0.022	0.103
	16	0.2899	1.444	1.714	17.228	8.382	24	-0.091	0.109
	17	0.2926	1.438	1.684	17.097	8.709	24	0.187	0.084
	18	0.2953	1.412	1.630	16.960	9.034	24	0.232	+0.037
	19	+0.2981	-1.358	-1.566	+16.818	+9.356	-24	-0.210	-0.019
	20	0.3008	1.280	1.511	16.670	9.675	24	0.126	0.067
	21	0.3036	1.185	1.474	16.518	9.990	24	-0.004	0.096
	22	0.3063	1.088	1.463	16.360	10.303	24	+0.124	0.099
	23	0.3090	0.998	1.474	16.197	10.612	24	0.231	0.079
	24	0.3118	0.924	1.500	16.029	10.918	24	0.298	0.044
	25	+0.3145	-0.869	-1.534	+15.857	+11.220	-24	+0.316	-0.001
	26	0.3172	0.832	1.566	15.680	11.519	24	0.287	+0.041
	27	0.3200	0.810	1.589	15.498	11.815	24	0.217	0.075
	28	0.3227	0.799	1.599	15.313	12.107	24	0.121	0.096
	29	0.3255	0.792	1.593	15.122	12.396	24	+0.012	0.100
	30	0.3282	0.782	1.570	14.927	12.682	24	-0.092	0.087
	31	+0.3309	-0.764	-1.532	+14.728	+12.964	-24	-0.178	+0.060
Nov.	1	0.3337	0.734	1.484	14.525	13.242	24	0.233	+0.024
	2	0.3364	0.688	1.431	14.317	13.517	24	0.250	-0.018
	3	0.3392	0.625	1.380	14.105	13.789	24	0.229	0.057
	4	0.3419	0.548	1.338	13.889	14.056	24	0.172	0.088
	5	0.3446	0.461	1.310	13.668	14.320	24	-0.091	0.104
	6	+0.3474	-0.369	-1.300	+13.443	+14.581	-24	+0.000	-0.102
	7	0.3501	0.279	1.309	13.214	14.837	24	0.084	0.081
	8	0.3528	0.199	1.334	12.980	15.090	24	0.141	-0.044
	9	0.3556	0.135	1.370	12.742	15.338	24	0.158	+0.003
	10	0.3583	0.089	1.407	12.499	15.582	24	0.126	0.052
	11	0.3611	0.062	1.434	12.253	15.822	24	+0.048	0.090
	12	+0.3638	-0.045	-1.439	+12.001	+16.058	-24	-0.061	+0.107
	13	0.3665	-0.028	1.417	11.746	16.289	24	0.169	0.096
	14	0.3693	+0.004	1.367	11.486	16.514	24	0.242	0.058
	15	0.3720	0.061	1.302	11.222	16.735	24	0.253	+0.004
	16	+0.3747	+0.148	-1.236	+10.954	+16.950	-24	-0.193	-0.051

BESSELIAN DAY NUMBERS, 2020.5
FOR 0^h TERRESTRIAL TIME

Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
Nov.	16	+0.3747	+0.148	-1.236	+10.954	+16.950	-24	-0.193	-0.051
	17	0.3775	0.256	1.186	10.683	17.160	24	-0.078	0.090
	18	0.3802	0.376	1.161	10.408	17.363	24	+0.062	0.105
	19	0.3830	0.491	1.163	10.129	17.562	24	0.191	0.092
	20	0.3857	0.592	1.186	9.848	17.754	23	0.282	0.059
	21	0.3884	0.674	1.220	9.564	17.941	23	0.322	-0.015
	22	+0.3912	+0.735	-1.256	+9.277	+18.122	-23	+0.310	+0.030
	23	0.3939	0.778	1.285	8.987	18.297	23	0.251	0.068
	24	0.3966	0.809	1.302	8.695	18.467	23	0.161	0.093
	25	0.3994	0.834	1.303	8.400	18.632	23	+0.053	0.102
	26	0.4021	0.860	1.287	8.103	18.790	24	-0.054	0.094
	27	0.4049	0.892	1.256	7.803	18.943	24	0.146	0.070
	28	+0.4076	+0.936	-1.214	+7.501	+19.091	-24	-0.211	+0.035
	29	0.4103	0.995	1.167	7.197	19.233	24	0.238	-0.006
	30	0.4131	1.070	1.120	6.891	19.369	24	0.226	0.047
Dec.	1	0.4158	1.161	1.081	6.582	19.500	24	0.176	0.080
	2	0.4185	1.263	1.056	6.272	19.625	23	0.099	0.101
	3	0.4213	1.371	1.049	5.959	19.745	23	-0.008	0.104
	4	+0.4240	+1.478	-1.062	+5.645	+19.859	-23	+0.079	-0.087
	5	0.4268	1.576	1.092	5.328	19.967	23	0.143	0.054
	6	0.4295	1.659	1.134	5.009	20.070	23	0.168	-0.009
	7	0.4322	1.723	1.180	4.689	20.166	23	0.146	+0.039
	8	0.4350	1.770	1.220	4.366	20.257	23	+0.078	0.079
	9	0.4377	1.803	1.242	4.042	20.342	23	-0.024	0.102
	10	+0.4405	+1.833	-1.241	+3.715	+20.420	-23	-0.136	+0.101
	11	0.4432	1.871	1.214	3.387	20.492	23	0.227	0.073
	12	0.4459	1.929	1.168	3.057	20.558	23	0.269	+0.026
	13	0.4487	2.015	1.115	2.726	20.616	23	0.243	-0.030
	14	0.4514	2.126	1.070	2.394	20.668	23	0.153	0.077
	15	0.4541	2.254	1.047	2.061	20.713	22	-0.020	0.104
	16	+0.4569	+2.386	-1.051	+1.727	+20.751	-22	+0.121	-0.104
	17	0.4596	2.508	1.082	1.392	20.782	22	0.237	0.078
	18	0.4624	2.611	1.130	1.057	20.806	22	0.305	-0.036
	19	0.4651	2.691	1.184	0.723	20.824	22	0.316	+0.012
	20	0.4678	2.750	1.235	0.388	20.835	22	0.275	0.056
	21	0.4706	2.794	1.274	+0.053	20.839	22	0.194	0.087
	22	+0.4733	+2.829	-1.297	-0.281	+20.836	-22	+0.090	+0.101
	23	0.4760	2.862	1.304	0.615	20.828	22	-0.019	0.099
	24	0.4788	2.899	1.295	0.949	20.812	22	0.117	0.080
	25	0.4815	2.945	1.274	1.282	20.791	22	0.190	0.048
	26	0.4843	3.006	1.245	1.614	20.763	22	0.229	+0.007
	27	0.4870	3.082	1.215	1.946	20.729	22	0.228	-0.035
	28	+0.4897	+3.174	-1.191	-2.277	+20.689	-22	-0.188	-0.072
	29	0.4925	3.278	1.180	2.607	20.643	22	0.115	0.097
	30	0.4952	3.390	1.186	2.936	20.591	21	-0.023	0.105
	31	0.4979	3.502	1.213	3.265	20.532	21	+0.070	0.093
	32	+0.5007	+3.607	-1.259	-3.592	+20.468	-21	+0.145	-0.063

SECOND-ORDER DAY NUMBERS, 2020
J FOR NORTHERN DECLINATIONS
FOR 0^h TT AND EQUINOX J 2020.5

Date		RIGHT ASCENSION												
		0^h 12^h	1^h 13^h	2^h 14^h	3^h 15^h	4^h 16^h	5^h 17^h	6^h 18^h	7^h 19^h	8^h 20^h	9^h 21^h	10^h 22^h	11^h 23^h	12^h 24^h
Jan.	2	-2	+3	+7	+9	+8	+5	+1	-4	-8	-10	-9	-6	-2
	12	-1	-1	-1	-1	0	0	0	0	0	0	-1	-1	-1
	22	-1	-2	-2	-2	-1	0	0	+1	+1	+1	0	-1	-1
Feb.	1	-1	-2	-3	-3	-2	-1	0	+1	+2	+2	+1	0	-1
	11	0	-2	-3	-4	-4	-2	-1	+1	+2	+3	+3	+1	0
	21	+1	-1	-3	-5	-5	-4	-2	0	+2	+4	+4	+3	+1
Mar.	2	+3	+1	-2	-5	-6	-6	-4	-2	+1	+4	+5	+5	+3
	12	+5	+2	-1	-5	-7	-8	-6	-3	0	+4	+6	+7	+5
	22	+7	+5	+1	-4	-7	-9	-8	-6	-2	+3	+6	+8	+7
Apr.	1	+9	+7	+3	-2	-6	-9	-10	-8	-4	+1	+5	+8	+9
	11	+10	+9	+6	0	-5	-9	-11	-10	-7	-1	+4	+8	+10
	21	+11	+11	+8	+3	-3	-9	-12	-12	-9	-4	+2	+8	+11
May	1	+10	+12	+10	+5	-1	-7	-11	-13	-11	-6	0	+6	+10
	11	+9	+12	+12	+8	+2	-5	-10	-13	-13	-9	-3	+4	+9
	21	+7	+12	+13	+10	+5	-2	-8	-13	-14	-11	-6	+1	+7
	31	+5	+10	+13	+11	+7	+1	-6	-11	-14	-12	-8	-2	+5
June	10	+2	+8	+12	+12	+9	+3	-3	-9	-13	-13	-10	-4	+2
	20	-1	+6	+10	+12	+10	+6	0	-7	-11	-13	-11	-7	-1
	30	-3	+3	+8	+11	+11	+7	+2	-4	-9	-12	-12	-8	-3
July	10	-5	0	+6	+9	+10	+8	+4	-1	-7	-10	-11	-9	-5
	20	-7	-2	+3	+7	+9	+9	+6	+1	-4	-8	-10	-10	-7
	30	-8	-4	0	+5	+8	+8	+7	+3	-1	-6	-9	-9	-8
Aug.	9	-8	-6	-2	+2	+5	+7	+7	+5	+1	-3	-6	-8	-8
	19	-7	-7	-4	0	+3	+6	+6	+6	+3	-1	-4	-7	-7
	29	-6	-7	-5	-3	+1	+3	+5	+6	+4	+2	-2	-4	-6
Sept.	8	-5	-6	-6	-4	-2	+1	+4	+5	+5	+3	+1	-2	-5
	18	-3	-5	-5	-5	-3	-1	+2	+4	+4	+4	+2	0	-3
	28	0	-3	-4	-5	-5	-3	-1	+2	+3	+4	+4	+2	0
Oct.	8	+2	-1	-3	-5	-5	-4	-3	0	+2	+4	+4	+3	+2
	18	+3	+1	-1	-3	-5	-5	-4	-2	0	+2	+4	+4	+3
	28	+5	+3	+1	-1	-4	-5	-6	-4	-2	0	+3	+4	+5
Nov.	7	+5	+5	+3	+1	-2	-5	-6	-6	-4	-2	+1	+4	+5
	17	+5	+6	+5	+3	0	-3	-6	-7	-6	-4	-1	+2	+5
	27	+4	+6	+7	+5	+2	-1	-5	-7	-8	-6	-3	0	+4
Dec.	7	+2	+5	+7	+7	+5	+1	-3	-6	-8	-8	-6	-2	+2
	17	0	+4	+7	+8	+7	+4	-1	-5	-8	-9	-8	-5	0
	27	-3	+2	+6	+9	+9	+6	+2	-3	-7	-10	-10	-7	-3
	37	-6	-1	+4	+8	+9	+8	+5	0	-5	-9	-10	-9	-6

The second-order day number J given in this table in units of $0^s.00001$

The apparent right ascension of a star is given by:

$\alpha = \alpha_1 + \tau\mu_\alpha/100 + Aa + Bb + Cc + Dd + E + J \tan^2\delta_1$

Where the position (α_1, δ_1) and centennial proper motion in right ascension (μ_α) are referred to the mean equator and equinox of J 2020.5

SECOND-ORDER DAY NUMBERS, 2020

J' FOR NORTHERN DECLINATIONS

FOR 0^h TT AND EQUINOX J 2020.5

Date		RIGHT ASCENSION												
		0^h 12^h	1^h 13^h	2^h 14^h	3^h 15^h	4^h 16^h	5^h 17^h	6^h 18^h	7^h 19^h	8^h 20^h	9^h 21^h	10^h 22^h	11^h 23^h	12^h 24^h
Jan.	2	-1	-1	-3	-6	-10	-13	-14	-14	-12	-9	-5	-2	-1
	12	0	0	-1	-1	-1	-1	-1	0	0	0	0	0	0
	22	-1	-1	0	-1	-1	-1	-1	-1	-2	-2	-2	-1	-1
Feb.	1	-4	-3	-2	-1	0	0	-1	-1	-2	-2	-3	-4	-3
	11	-5	-5	-4	-3	-2	-1	-1	-1	-1	-3	-4	-5	-5
	21	-7	-7	-6	-5	-3	-2	-1	-1	-1	-2	-4	-6	-7
Mar.	2	-8	-9	-9	-8	-6	-3	-2	-1	-1	-2	-4	-6	-8
	12	-9	-11	-11	-10	-8	-5	-3	-1	-1	-2	-4	-6	-9
	22	-9	-12	-13	-13	-11	-8	-4	-2	-1	-1	-3	-6	-9
Apr.	1	-9	-12	-14	-15	-13	-10	-7	-3	-1	-1	-2	-5	-9
	11	-8	-12	-15	-17	-16	-13	-9	-5	-2	-1	-1	-4	-8
	21	-7	-11	-15	-18	-18	-16	-12	-7	-3	-1	-1	-3	-7
May	1	-5	-10	-15	-18	-19	-18	-14	-10	-5	-2	-1	-2	-5
	11	-4	-8	-13	-17	-20	-19	-16	-12	-7	-3	-1	-1	-4
	21	-2	-7	-12	-16	-20	-20	-18	-14	-9	-4	-1	-1	-2
	31	-1	-5	-9	-15	-18	-20	-19	-16	-11	-6	-2	-1	-1
June	10	-1	-3	-7	-12	-17	-19	-19	-17	-13	-8	-4	-1	-1
	20	-1	-2	-5	-10	-14	-18	-19	-18	-15	-10	-5	-2	-1
	30	-1	-1	-3	-7	-12	-16	-18	-18	-15	-11	-7	-3	-1
July	10	-1	-1	-2	-5	-9	-13	-16	-17	-15	-12	-8	-4	-1
	20	-2	-1	-1	-3	-7	-10	-14	-15	-15	-13	-9	-5	-2
	30	-3	-1	-1	-2	-4	-8	-11	-13	-14	-13	-10	-7	-3
Aug.	9	-5	-2	-1	-1	-3	-5	-8	-11	-12	-12	-10	-8	-5
	19	-6	-3	-1	-1	-1	-3	-6	-8	-10	-11	-10	-8	-6
	29	-7	-4	-2	-1	-1	-2	-4	-6	-8	-9	-10	-9	-7
Sept.	8	-7	-5	-3	-1	-1	-1	-2	-4	-6	-8	-9	-9	-7
	18	-8	-6	-5	-3	-1	-1	-1	-2	-4	-6	-7	-8	-8
	28	-8	-7	-6	-4	-2	-1	-1	-1	-2	-4	-6	-7	-8
Oct.	8	-7	-7	-7	-6	-4	-2	-1	-1	-1	-2	-4	-6	-7
	18	-6	-7	-8	-7	-5	-4	-2	-1	-1	-1	-3	-4	-6
	28	-5	-7	-8	-8	-7	-6	-4	-2	-1	-1	-1	-3	-5
Nov.	7	-4	-6	-8	-9	-9	-8	-6	-3	-2	-1	-1	-2	-4
	17	-3	-5	-7	-9	-10	-10	-8	-6	-3	-1	-1	-1	-3
	27	-2	-4	-6	-9	-11	-11	-10	-8	-5	-3	-1	-1	-2
Dec.	7	-1	-2	-5	-8	-11	-12	-12	-10	-8	-5	-2	-1	-1
	17	-1	-1	-4	-7	-11	-13	-14	-13	-10	-7	-4	-1	-1
	27	-1	-1	-3	-6	-9	-12	-14	-14	-12	-9	-6	-3	-1
	37	-2	-1	-1	-4	-8	-12	-14	-15	-15	-12	-8	-4	-2

The second-order day number J' given in this table in units of 0".0001

The apparent declination of a star is given by:

$\delta = \delta_1 + \tau\mu_\delta/100 + Aa' + Bb' + Cc' + J' \tan\delta_1$

Where the declination (δ_1) and centennial proper motion in declination (μ_δ) are referred to the mean equator and equinox of J 2020.5

SECOND-ORDER DAY NUMBERS, 2020
J FOR SOUTHERN DECLINATIONS
FOR 0^h TT AND EQUINOX J 2020.5

Date		RIGHT ASCENSION												
		0^h 12^h	1^h 13^h	2^h 14^h	3^h 15^h	4^h 16^h	5^h 17^h	6^h 18^h	7^h 19^h	8^h 20^h	9^h 21^h	10^h 22^h	11^h 23^h	12^h 24^h
Jan.	2	-3	-1	+2	+4	+5	+4	+2	0	-3	-5	-6	-5	-3
	12	-10	1	11	18	21	17	9	-2	-12	-19	-22	-18	-10
	22	-13	-3	+7	+15	+19	+18	+12	+2	-8	-16	-20	-19	-13
Feb.	1	-14	-6	+3	+11	+16	+17	+13	+5	-4	-12	-17	-18	-14
	11	-14	-8	0	+7	+13	+15	+13	+7	-1	-8	-14	-16	-14
	21	-14	-10	-3	+4	+10	+13	+13	+9	+2	-5	-11	-14	-14
Mar.	2	-12	-10	-5	+1	+6	+10	+11	+9	+4	-2	-7	-11	-12
	12	-10	-10	-7	-2	+3	+7	+9	+9	+6	+1	-4	-8	-10
	22	-8	-9	-7	-4	0	+4	+7	+8	+6	+3	-1	-5	-8
Apr.	1	-5	-7	-7	-5	-2	+2	+4	+6	+6	+4	+1	-3	-5
	11	-3	-5	-6	-5	-3	-1	+2	+4	+5	+4	+2	0	-3
	21	-1	-3	-4	-5	-4	-2	0	+2	+3	+4	+3	+1	-1
May	1	+1	-1	-3	-4	-4	-3	-2	0	+2	+3	+3	+2	+1
	11	+2	0	-1	-2	-3	-3	-3	-1	0	+1	+2	+2	+2
	21	+2	+1	0	-1	-2	-3	-3	-2	-1	0	+1	+2	+2
	31	+2	+2	+1	0	-1	-2	-3	-3	-2	-1	0	+1	+2
June	10	+1	+2	+2	+1	0	-1	-2	-3	-3	-2	-1	0	+1
	20	0	+1	+2	+2	+2	0	-1	-2	-3	-3	-3	-1	0
	30	-2	0	+1	+2	+2	+2	+1	-1	-2	-3	-3	-3	-2
July	10	-3	-2	0	+2	+3	+3	+2	+1	-1	-3	-4	-4	-3
	20	-4	-3	-1	+1	+2	+3	+3	+2	0	-2	-3	-4	-4
	30	-5	-4	-3	-1	+1	+3	+4	+3	+2	0	-2	-4	-5
Aug.	9	-5	-5	-4	-2	0	+2	+4	+4	+3	+1	-1	-3	-5
	19	-4	-6	-6	-4	-2	+1	+3	+5	+5	+3	+1	-2	-4
	29	-3	-5	-6	-6	-3	-1	+2	+4	+5	+5	+2	0	-3
Sept.	8	-2	-4	-6	-7	-5	-3	+1	+3	+5	+6	+4	+2	-2
	18	0	-3	-6	-7	-7	-5	-1	+2	+5	+6	+6	+4	0
	28	+2	-1	-5	-7	-7	-6	-3	0	+4	+6	+6	+5	+2
Oct.	8	+4	+1	-3	-6	-7	-7	-5	-2	+2	+5	+6	+6	+4
	18	+6	+3	-1	-4	-7	-8	-7	-4	0	+3	+6	+7	+6
	28	+7	+5	+1	-2	-6	-8	-8	-6	-2	+1	+5	+7	+7
Nov.	7	+7	+6	+3	0	-4	-7	-8	-7	-4	-1	+3	+6	+7
	17	+6	+6	+5	+2	-2	-5	-7	-7	-6	-3	+1	+4	+6
	27	+5	+6	+6	+3	0	-3	-6	-7	-7	-4	-1	+2	+5
Dec.	7	+3	+5	+6	+4	+2	-1	-4	-6	-7	-5	-3	0	+3
	17	+1	+3	+5	+5	+3	+1	-2	-4	-6	-6	-4	-2	+1
	27	-1	+2	+4	+5	+4	+2	0	-3	-5	-6	-5	-3	-1
	37	-2	0	+2	+4	+4	+3	+1	-1	-3	-5	-5	-4	-2

The second-order day number J given in this table in units of $0^s.00001$

The apparent right ascension of a star is given by:
$\alpha = \alpha_1 + \tau\mu_\alpha/100 + Aa + Bb + Cc + Dd + E + J \tan^2\delta_1$

Where the position (α_1, δ_1) and centennial proper motion in right ascension (μ_α) are referred to the mean equator and equinox of J 2020.5

SECOND-ORDER DAY NUMBERS, 2020
J' FOR SOUTHERN DECLINATIONS
FOR 0^h TT AND EQUINOX J 2020.5

Date		RIGHT ASCENSION												
		0^h 12^h	1^h 13^h	2^h 14^h	3^h 15^h	4^h 16^h	5^h 17^h	6^h 18^h	7^h 19^h	8^h 20^h	9^h 21^h	10^h 22^h	11^h 23^h	12^h 24^h
Jan.	2	-1	-1	-1	-2	-4	-6	-7	-8	-8	-7	-5	-3	-1
	12	-2	-1	-3	-9	-17	-25	-31	-32	-30	-24	-16	-8	-2
	22	-4	-1	-2	-6	-13	-21	-27	-30	-29	-24	-17	-10	-4
Feb.	1	-5	-1	-1	-4	-10	-17	-23	-27	-27	-24	-18	-11	-5
	11	-6	-2	-1	-2	-6	-12	-18	-23	-24	-22	-18	-12	-6
	21	-8	-3	-1	-1	-4	-9	-14	-18	-21	-21	-18	-13	-8
Mar.	2	-9	-4	-1	-1	-2	-6	-10	-15	-17	-18	-17	-13	-9
	12	-9	-5	-2	-1	-1	-3	-7	-11	-14	-15	-15	-12	-9
	22	-9	-6	-3	-1	-1	-2	-4	-7	-10	-12	-13	-11	-9
Apr.	1	-9	-7	-4	-2	-1	-1	-2	-4	-7	-9	-10	-10	-9
	11	-8	-7	-5	-3	-1	-1	-1	-2	-4	-6	-8	-8	-8
	21	-7	-6	-5	-3	-2	-1	-1	-1	-2	-4	-6	-7	-7
May	1	-6	-6	-5	-4	-3	-1	-1	-1	-1	-2	-4	-5	-6
	11	-4	-5	-5	-4	-3	-2	-1	-1	-1	-1	-2	-3	-4
	21	-3	-4	-4	-4	-4	-3	-2	-1	-1	-1	-1	-2	-3
	31	-2	-3	-3	-4	-4	-4	-3	-2	-1	-1	-1	-1	-2
June	10	-1	-2	-3	-3	-4	-4	-4	-3	-2	-1	-1	-1	-1
	20	-1	-1	-2	-3	-4	-4	-4	-4	-3	-2	-1	-1	-1
	30	-1	-1	-1	-2	-3	-4	-5	-5	-4	-3	-2	-1	-1
July	10	-1	-1	-1	-1	-2	-4	-5	-5	-5	-5	-4	-2	-1
	20	-2	-1	-1	-1	-1	-3	-4	-5	-6	-6	-5	-4	-2
	30	-4	-2	-1	-1	-1	-2	-3	-5	-6	-7	-6	-5	-4
Aug.	9	-6	-4	-2	-1	-1	-1	-3	-4	-6	-7	-8	-7	-6
	19	-7	-5	-3	-2	-1	-1	-2	-4	-6	-7	-8	-8	-7
	29	-9	-7	-5	-3	-1	-1	-1	-3	-5	-7	-8	-9	-9
Sept.	8	-10	-9	-7	-4	-2	-1	-1	-2	-4	-6	-8	-10	-10
	18	-11	-10	-9	-6	-4	-2	-1	-1	-2	-5	-7	-10	-11
	28	-10	-11	-10	-8	-5	-3	-1	-1	-2	-4	-6	-9	-10
Oct.	8	-10	-11	-11	-9	-7	-4	-2	-1	-1	-2	-5	-8	-10
	18	-9	-11	-12	-11	-9	-6	-3	-1	-1	-1	-3	-6	-9
	28	-7	-10	-11	-11	-10	-7	-5	-2	-1	-1	-2	-5	-7
Nov.	7	-6	-8	-10	-11	-11	-9	-6	-3	-1	-1	-1	-3	-6
	17	-4	-7	-9	-11	-11	-10	-7	-5	-2	-1	-1	-2	-4
	27	-2	-5	-7	-9	-10	-10	-8	-6	-3	-1	-1	-1	-2
Dec.	7	-1	-3	-5	-8	-9	-10	-9	-7	-5	-2	-1	-1	-1
	17	-1	-2	-4	-6	-8	-9	-9	-8	-6	-4	-2	-1	-1
	27	-1	-1	-2	-4	-6	-7	-8	-8	-6	-5	-3	-1	-1
	37	-1	-1	-1	-2	-4	-6	-7	-7	-7	-5	-4	-2	-1

The second-order day number J' given in this table in units of 0".0001

The apparent declination of a star is given by:
$\delta = \delta_1 + \tau\mu_\delta/100 + Aa' + Bb' + Cc' + J' \tan\delta_1$

Where the declination (δ_1) and centennial proper motion in declination (μ_δ) are referred to the mean equator and equinox of J 2020.5

POSITION AND VELOCITY OF THE EARTH, 2020
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
Jan.	0	-0.152 871 14	+0.898 582 71	+0.389 562 63	-1729 8043	-245 9990	-106 5702
	1	0.170 144 39	0.895 983 83	0.388 436 66	1724 7546	273 7580	118 6171
	2	0.187 364 42	0.893 107 92	0.387 190 45	1719 1615	301 4054	130 6168
	3	0.204 525 83	0.889 956 13	0.385 824 50	1713 320	328 9322	142 5646
	4	0.221 623 30	0.886 529 71	0.384 339 34	1706 3736	356 3296	154 4564
	5	0.238 651 57	0.882 829 99	0.382 735 57	1699 1940	383 5892	166 2880
	6	-0.255 605 47	+0.878 858 40	+0.381 013 80	-1691 5013	-410 7039	-178 0556
	7	0.272 479 91	0.874 616 42	0.379 174 68	1683 3042	437 6671	189 7555
	8	0.289 269 90	0.870 105 58	0.377 218 92	1674 6119	464 4738	201 3853
	9	0.305 970 53	0.865 327 48	0.375 147 22	1665 4332	491 1210	212 9426
	10	0.322 576 97	0.860 283 70	0.372 960 31	1655 7764	517 6076	224 4264
	11	0.339 084 48	0.854 975 86	0.370 658 94	1645 6471	543 9343	235 8369
	12	-0.355 488 35	+0.849 405 54	+0.368 243 82	-1635 0486	-570 1033	-247 1746
	13	0.371 783 89	0.843 574 31	0.365 715 68	1623 9804	596 1164	258 4405
	14	0.387 966 38	0.837 483 73	0.363 075 24	1612 4379	621 9737	269 6355
	15	0.404 031 05	0.831 135 36	0.360 323 21	1600 4148	647 6726	280 7594
	16	0.419 973 05	0.824 530 83	0.357 460 30	1587 9031	673 2072	291 8108
	17	0.435 787 45	0.817 671 80	0.354 487 24	1574 8948	698 5683	302 7869
	18	-0.451 469 27	+0.810 560 08	+0.351 404 82	-1561 3839	-723 7435	-313 6836
	19	0.467 013 44	0.803 197 59	0.348 213 86	1547 3662	748 7187	324 4954
	20	0.482 414 89	0.795 586 42	0.344 915 22	1532 8396	773 4783	335 2166
	21	0.497 668 54	0.787 728 80	0.341 509 85	1517 8050	798 0060	345 8407
	22	0.512 769 31	0.779 627 13	0.337 998 75	1502 2658	822 2855	356 3608
	23	0.527 712 19	0.771 283 97	0.334 383 00	1486 2275	846 3008	366 7701
	24	-0.542 492 22	+0.762 702 05	+0.330 663 74	-1469 6977	-870 0369	-377 0621
	25	0.557 104 54	0.753 884 21	0.326 842 17	1452 6861	893 4802	387 2304
	26	0.571 544 37	0.744 833 46	0.322 919 56	1435 2033	916 6179	397 2692
	27	0.585 807 07	0.735 552 91	0.318 897 24	1417 2612	939 4394	407 1732
	28	0.599 888 10	0.726 045 76	0.314 776 56	1398 8716	961 9352	416 9378
	29	0.613 783 05	0.716 315 32	0.310 558 96	1380 0469	984 0970	426 5590
	30	-0.627 487 63	+0.706 364 96	+0.306 245 87	-1360 7991	-1005 9176	-436 0329
	31	0.640 997 67	0.696 198 12	0.301 838 80	1341 1404	1027 3907	445 3562
Feb.	1	0.654 309 11	0.685 818 32	0.297 339 26	1321 0826	1048 5106	454 5261
	2	0.667 418 03	0.675 229 10	0.292 748 80	1300 6380	1069 2722	463 5396
	3	0.680 320 62	0.664 434 08	0.288 069 00	1279 8191	1089 6713	472 3944
	4	0.693 013 21	0.653 436 90	0.283 301 45	1258 6384	1109 7045	481 0884
	5	-0.705 492 23	+0.642 241 22	+0.278 447 77	-1237 1090	-1129 3701	-489 6203
	6	0.717 754 27	0.630 850 72	0.273 509 59	1215 2436	1148 6681	497 9895
	7	0.729 796 02	0.619 269 07	0.268 488 52	1193 0540	1167 6006	506 1962
	8	0.741 614 30	0.607 499 91	0.263 386 20	1170 5499	1186 1718	514 2420
	9	0.753 205 99	0.595 546 82	0.258 204 21	1147 7375	1204 3874	522 1294
	10	0.764 568 03	0.583 413 33	0.252 944 13	1124 6189	1222 2523	529 8610
	11	-0.775 697 34	+0.571 102 93	+0.247 607 50	-1101 1919	-1239 7702	-537 4390
	12	0.786 590 82	0.558 619 09	0.242 195 86	1077 4515	1256 9407	544 8647
	13	0.797 245 31	0.545 965 29	0.236 710 72	1053 3916	1273 7590	552 1373
	14	0.807 657 57	0.533 145 11	0.231 153 63	1029 0075	1290 2165	559 2544
	15	-0.817 824 37	+0.520 162 21	+0.225 526 16	-1004 2967	-1306 3013	-566 2120

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2020
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
Jan.	0	-1150	-439 823	-191 099	+439 825	-967	+432	+191 096	-1273	-183
	1	1150	439 873	191 121	439 874	967	411	191 117	1251	183
	2	1150	439 912	191 138	439 913	968	395	191 134	1236	183
	3	1150	439 947	191 153	439 948	968	386	191 150	1227	183
	4	1151	439 984	191 169	439 986	968	384	191 166	1225	183
	5	1151	440 030	191 190	440 032	968	389	191 186	1230	183
	6	-1151	-440 091	-191 216	+440 093	-968	+398	+191 213	-1240	-183
	7	1152	440 171	191 251	440 173	969	409	191 247	1251	183
	8	1152	440 272	191 295	440 274	969	418	191 291	1260	183
	9	1153	440 391	191 346	440 392	970	421	191 342	1263	183
	10	1153	440 520	191 402	440 522	970	413	191 399	1257	183
	11	1154	440 650	191 459	440 652	971	394	191 455	1238	183
	12	-1155	-440 767	-191 509	+440 769	-971	+365	+191 506	-1209	-183
	13	1155	440 861	191 550	440 862	972	329	191 547	1173	183
	14	1156	440 928	191 579	440 929	972	292	191 576	1137	184
	15	1156	440 971	191 598	440 972	972	262	191 595	1107	184
	16	1156	441 000	191 611	441 001	972	242	191 608	1087	184
	17	1156	441 029	191 623	441 030	973	235	191 620	1080	184
	18	-1156	-441 069	-191 640	+441 070	-973	+238	+191 638	-1083	-184
	19	1157	441 128	191 666	441 129	973	246	191 663	1092	184
	20	1157	441 209	191 702	441 211	973	256	191 699	1102	184
	21	1158	441 310	191 745	441 311	974	262	191 742	1108	184
	22	1158	441 422	191 794	441 423	974	259	191 791	1106	184
	23	1159	441 537	191 844	441 539	975	248	191 841	1095	184
	24	-1159	-441 646	-191 891	+441 647	-975	+227	+191 888	-1074	-184
	25	1160	441 740	191 932	441 742	976	199	191 929	1047	184
	26	1160	441 817	191 965	441 818	976	167	191 963	1015	184
	27	1161	441 873	191 990	441 874	976	135	191 987	0983	184
	28	1161	441 913	192 007	441 914	976	105	192 005	0954	184
	29	1161	441 940	192 019	441 941	977	81	192 017	0930	184
	30	-1161	-441 960	-192 028	+441 961	-977	+64	+192 026	-0913	-184
	31	1161	441 980	192 036	441 981	977	55	192 034	0903	184
Feb.	1	1161	442 007	192 048	442 008	977	52	192 046	0901	184
	2	1161	442 045	192 065	442 046	977	55	192 063	0904	184
	3	1162	442 100	192 089	442 101	977	60	192 086	0910	184
	4	1162	442 174	192 121	442 175	978	66	192 119	0915	185
	5	-1163	-442 267	-192 161	+442 268	-978	+67	+192 159	-0917	-185
	6	1163	442 374	192 207	442 375	978	61	192 205	0911	185
	7	1164	442 487	192 256	442 487	979	43	192 254	0894	185
	8	1164	442 593	192 302	442 594	979	+15	192 301	0866	185
	9	1165	442 680	192 340	442 681	980	-23	192 339	0828	185
	10	1165	442 741	192 367	442 741	980	64	192 365	0788	185
	11	-1165	-442 773	-192 381	+442 774	-980	-100	+192 379	-0751	-185
	12	1165	442 786	192 387	442 787	980	127	192 385	0725	185
	13	1165	442 794	192 390	442 795	980	140	192 389	0712	185
	14	1165	442 811	192 397	442 811	980	140	192 396	0712	185
	15	-1166	-442 846	-192 413	+442 847	-981	-133	+192 411	-0720	-185

Values are in units of 10^{-8}

POSITION AND VELOCITY OF THE EARTH, 2020
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
Feb.	15	-0.817 824 37	+0.520 162 21	+0.225 526 16	-1004 2967	-1306 3013	-566 2120
	16	0.827 742 42	0.507 020 37	0.219 829 94	979 2604	1322 0002	573 0051
	17	0.837 408 50	0.493 723 53	0.214 066 63	953 9028	1337 2996	579 6283
	18	0.846 819 43	0.480 275 75	0.208 237 96	928 2310	1352 1863	586 0763
	19	0.855 972 10	0.466 681 22	0.202 345 70	902 2539	1366 6481	592 3437
	20	0.864 863 53	0.452 944 24	0.196 391 70	875 9825	1380 6738	598 4256
	21	-0.873 490 81	+0.439 069 23	+0.190 377 83	-849 4289	-1394 2536	-604 3174
	22	0.881 851 21	0.425 060 69	0.184 306 00	822 6062	1407 3788	610 0149
	23	0.889 942 09	0.410 923 20	0.178 178 19	795 5283	1420 0416	615 5146
	24	0.897 760 97	0.396 661 42	0.171 996 38	768 2096	1432 2364	620 8131
	25	0.905 305 53	0.382 280 05	0.165 762 60	740 6650	1443 9580	625 9079
	26	0.912 573 57	0.367 783 85	0.159 478 91	712 9092	1455 2028	630 7967
	27	-0.919 563 05	+0.353 177 59	+0.153 147 36	-684 9569	-1465 9680	-635 4777
	28	0.926 272 10	0.338 466 09	0.146 770 05	656 8227	1476 2519	639 9498
	29	0.932 698 95	0.323 654 16	0.140 349 07	628 5210	1486 0538	644 2119
Mar.	1	0.938 842 01	0.308 746 62	0.133 886 51	600 0659	1495 3732	648 2634
	2	0.944 699 80	0.293 748 30	0.127 384 50	571 4718	1504 2111	652 1043
	3	0.950 271 03	0.278 664 00	0.120 845 13	542 7527	1512 5691	655 7346
	4	-0.955 554 49	+0.263 498 51	+0.114 270 51	-513 9227	-1520 4504	-659 1550
	5	0.960 549 16	0.248 256 57	0.107 662 72	484 9953	1527 8594	662 3674
	6	0.965 254 11	0.232 942 87	0.101 023 85	455 9828	1534 8026	665 3740
	7	0.969 668 56	0.217 562 04	0.094 355 92	426 8956	1541 2885	668 1782
	8	0.973 791 80	0.202 118 60	0.087 660 94	397 7405	1547 3266	670 7842
	9	0.977 623 16	0.186 616 97	0.080 940 88	368 5201	1552 9259	673 1967
	10	-0.981 161 98	+0.171 061 51	+0.074 197 64	-339 2325	-1558 0939	-675 4200
	11	0.984 407 56	0.155 456 52	0.067 433 10	309 8726	1562 8338	677 4565
	12	0.987 359 17	0.139 806 27	0.060 649 13	280 4345	1567 1436	679 3071
	13	0.990 015 98	0.124 115 10	0.053 847 58	250 9140	1571 0168	680 9703
	14	0.992 377 17	0.108 387 42	0.047 030 36	221 3100	1574 4438	682 4428
	15	0.994 441 91	0.092 627 75	0.040 199 38	191 6260	1577 4139	683 7207
	16	-0.996 209 45	+0.076 840 71	+0.033 356 61	-161 8695	-1579 9162	-684 7999
	17	0.997 679 09	0.061 031 01	0.026 504 05	132 0504	1581 9420	685 6761
	18	0.998 850 29	0.045 203 48	0.019 643 77	102 1807	1583 4835	686 3461
	19	0.999 722 58	0.029 362 98	0.012 777 83	72 2736	1584 5352	686 8068
	20	1.000 295 68	+0.013 514 42	0.005 908 34	42 3429	1585 0926	687 0562
	21	1.000 569 41	-0.002 337 22	+0.000 962 58	-12 4027	1585 1526	687 0923
	22	-1.000 543 75	-0.018 186 96	-0.007 832 79	+17 5327	-1584 7135	-686 9139
	23	1.000 218 82	0.034 029 82	0.014 700 14	47 4486	1583 7742	686 5199
	24	0.999 594 89	0.049 860 78	0.021 562 47	77 3304	1582 3347	685 9098
	25	0.998 672 37	0.065 674 85	0.028 417 62	107 1636	1580 3964	685 0837
	26	0.997 451 83	0.081 467 05	0.035 263 43	136 9335	1577 9611	684 0418
	27	0.995 933 96	0.097 232 43	0.042 097 74	166 6259	1575 0322	682 7849
	28	-0.994 119 62	-0.112 966 06	-0.048 918 41	+196 2266	-1571 6135	-681 3143
	29	0.992 009 78	0.128 663 08	0.055 723 32	225 7221	1567 7099	679 6315
	30	0.989 605 57	0.144 318 66	0.062 510 34	255 0990	1563 3273	677 7386
	31	0.986 908 24	0.159 928 05	0.069 277 40	284 3446	1558 4724	675 6380
Apr.	1	-0.983 919 16	-0.175 486 56	-0.076 022 42	+313 4467	-1553 1534	-673 3330

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2020
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
Feb.	15	-1166	-442 846	-192 413	+442 847	-981	-133	+192 411	-0720	-185
	16	1166	442 905	192 438	442 905	981	123	192 437	0730	185
	17	1166	442 983	192 472	442 983	981	116	192 471	0737	185
	18	1167	443 074	192 511	443 074	982	116	192 510	0737	185
	19	1167	443 169	192 553	443 169	982	125	192 551	0728	185
	20	1168	443 259	192 592	443 259	982	143	192 591	0711	185
	21	-1168	-443 337	-192 626	+443 337	-983	-168	+192 625	-0686	-186
	22	1169	443 398	192 652	443 398	983	198	192 651	0656	186
	23	1169	443 440	192 671	443 441	983	228	192 670	0626	186
	24	1169	443 465	192 681	443 465	983	257	192 681	0598	186
	25	1169	443 476	192 686	443 476	983	280	192 686	0574	186
	26	1169	443 478	192 687	443 479	983	296	192 687	0558	186
	27	-1169	-443 479	-192 688	+443 479	-983	-305	+192 687	-0550	-186
	28	1169	443 485	192 690	443 485	983	306	192 690	0548	186
	29	1169	443 501	192 697	443 501	983	301	192 697	0553	186
Mar.	1	1169	443 532	192 711	443 532	984	292	192 710	0562	186
	2	1170	443 581	192 732	443 582	984	283	192 732	0572	186
	3	1170	443 649	192 762	443 649	984	276	192 761	0580	186
	4	-1170	-443 731	-192 797	+443 732	-984	-274	+192 797	-0581	-186
	5	1171	443 823	192 837	443 824	985	282	192 837	0574	186
	6	1171	443 915	192 877	443 915	985	301	192 877	0556	186
	7	1172	443 995	192 912	443 995	986	329	192 911	0528	186
	8	1172	444 052	192 937	444 052	986	363	192 937	0494	186
	9	1172	444 082	192 950	444 082	986	397	192 950	0460	186
	10	-1172	-444 088	-192 953	+444 088	-986	-423	+192 953	-0434	-186
	11	1172	444 082	192 950	444 082	986	435	192 950	0422	186
	12	1172	444 080	192 949	444 080	986	433	192 949	0424	186
	13	1172	444 096	192 956	444 096	986	420	192 956	0437	186
	14	1172	444 137	192 974	444 137	986	402	192 974	0455	186
	15	1173	444 201	193 002	444 202	987	385	193 002	0472	186
	16	-1173	-444 282	-193 037	+444 282	-987	-376	+193 037	-0482	-186
	17	1174	444 369	193 075	444 369	987	375	193 075	0483	186
	18	1174	444 453	193 111	444 453	988	383	193 111	0475	186
	19	1175	444 526	193 143	444 526	988	399	193 143	0459	187
	20	1175	444 582	193 167	444 582	988	420	193 167	0438	187
	21	1175	444 620	193 184	444 620	988	443	193 184	0416	187
	22	-1175	-444 641	-193 193	+444 641	-989	-464	+193 193	-0395	-187
	23	1175	444 648	193 196	444 648	989	480	193 196	0379	187
	24	1175	444 645	193 195	444 645	989	490	193 195	0369	187
	25	1175	444 639	193 192	444 639	989	492	193 193	0367	187
	26	1175	444 638	193 192	444 638	989	486	193 192	0373	187
	27	1175	444 646	193 195	444 646	989	474	193 196	0385	187
	28	-1175	-444 669	-193 205	+444 669	-989	-457	+193 206	-0402	-187
	29	1176	444 710	193 223	444 710	989	438	193 223	0421	187
	30	1176	444 769	193 249	444 769	989	422	193 249	0438	187
	31	1176	444 844	193 281	444 844	989	410	193 281	0450	187
Apr.	1	-1177	-444 930	-193 319	+444 930	-990	-406	+193 318	-0454	-187

Values are in units of 10^{-8}

POSITION AND VELOCITY OF THE EARTH, 2020
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
Apr.	1	-0.983 919 16	-0.175 486 56	-0.076 022 42	+313 4467	-1553 1534	-673 3330
	2	0.980 639 82	0.190 989 60	0.082 743 39	342 3939	1547 3792	670 8271
	3	0.977 071 83	0.206 432 67	0.089 438 31	371 1766	1541 1605	668 1248
	4	0.973 216 86	0.221 811 37	0.096 105 24	399 7870	1534 5089	665 2310
	5	0.969 076 68	0.237 121 44	0.102 742 31	428 2208	1527 4372	662 1517
	6	0.964 653 04	0.252 358 75	0.109 347 68	456 4772	1519 9570	658 8928
	7	-0.959 947 71	-0.267 519 26	-0.115 919 58	+484 5597	-1512 0781	-655 4593
	8	0.954 962 40	0.282 599 01	0.122 456 30	512 4747	1503 8066	651 8555
	9	0.949 698 75	0.297 594 08	0.128 956 13	540 2294	1495 1431	648 0831
	10	0.944 158 33	0.312 500 55	0.135 417 40	567 8290	1486 0838	644 1416
	11	0.938 342 68	0.327 314 41	0.141 838 39	595 2754	1476 6215	640 0292
	12	0.932 253 35	0.342 031 61	0.148 217 40	622 5652	1466 7478	635 7424
	13	-0.925 891 93	-0.356 647 97	-0.154 552 65	+649 6909	-1456 4553	-631 2781
	14	0.919 260 11	0.371 159 30	0.160 842 36	676 6424	1445 7385	626 6339
	15	0.912 359 70	0.385 561 32	0.167 084 72	703 4073	1434 5937	621 8076
	16	0.905 192 63	0.399 849 74	0.173 277 90	729 9729	1423 0197	616 7981
	17	0.897 760 95	0.414 020 28	0.179 420 07	756 3259	1411 0169	611 6053
	18	0.890 066 86	0.428 068 66	0.185 509 40	782 4537	1398 5868	606 2289
	19	-0.882 112 67	-0.441 990 60	-0.191 544 04	+808 3433	-1385 7319	-600 6696
	20	0.873 900 83	0.455 781 89	0.197 522 18	833 9821	1372 4556	594 9287
	21	0.865 433 91	0.469 438 32	0.203 442 01	859 3578	1358 7623	589 0069
	22	0.856 714 59	0.482 955 76	0.209 301 73	884 4579	1344 6568	582 9062
	23	0.847 745 71	0.496 330 11	0.215 099 54	909 2701	1330 1449	576 6284
	24	0.838 530 19	0.509 557 33	0.220 833 71	933 7822	1315 2337	570 1759
	25	-0.829 071 10	-0.522 633 47	-0.226 502 49	+957 9825	-1299 9310	-563 5517
	26	0.819 371 62	0.535 554 67	0.232 104 18	981 8596	1284 2453	556 7591
	27	0.809 435 02	0.548 317 14	0.237 637 12	1005 4033	1268 1869	549 8020
	28	0.799 264 70	0.560 917 20	0.243 099 69	1028 6039	1251 7665	542 6846
	29	0.788 864 12	0.573 351 30	0.248 490 30	1051 4528	1234 9958	535 4119
	30	0.778 236 84	0.585 615 99	0.253 807 43	1073 9433	1217 8875	527 9892
May	1	-0.767 386 46	-0.597 707 97	-0.259 049 60	+1096 0701	-1200 4548	-520 4224
	2	0.756 316 66	0.609 624 05	0.264 215 41	1117 8301	1182 7116	512 7178
	3	0.745 031 08	0.621 361 21	0.269 303 52	1139 2238	1164 6715	504 8817
	4	0.733 533 39	0.632 916 54	0.274 312 63	1160 2540	1146 3469	496 9204
	5	0.721 827 19	0.644 287 24	0.279 241 53	1180 9268	1127 7482	488 8398
	6	0.709 916 02	0.655 470 61	0.284 089 04	1201 2509	1108 8816	480 6436
	7	-0.697 803 31	-0.666 463 98	-0.288 854 02	+1221 2346	-1089 7494	-472 3344
	8	0.685 492 44	0.677 264 70	0.293 535 35	1240 8849	1070 3493	463 9122
	9	0.672 986 71	0.687 870 06	0.298 131 89	1260 2047	1050 6764	455 3759
	10	0.660 289 45	0.698 277 30	0.302 642 48	1279 1924	1030 7243	446 7230
	11	0.647 403 99	0.708 483 60	0.307 065 95	1297 8427	1010 4883	437 9511
	12	0.634 333 75	0.718 486 11	0.311 401 10	1316 1464	989 9649	429 0587
	13	-0.621 082 25	-0.728 281 94	-0.315 646 72	+1334 0933	-969 1534	-420 0446
	14	0.607 653 11	0.737 868 22	0.319 801 59	1351 6722	948 0554	410 9090
	15	0.594 050 07	0.747 242 10	0.323 864 50	1368 8722	926 6742	401 6528
	16	0.580 276 97	0.756 400 78	0.327 834 25	1385 6829	905 0148	392 2771
	17	-0.566 337 74	-0.765 341 49	-0.331 709 65	+1402 0944	-883 0822	-382 7839

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2020
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
Apr.	1	-1177	-444 930	-193 319	+444 930	-990	-406	+193 318	-0454	-187
	2	1177	445 018	193 357	445 018	990	411	193 357	0449	187
	3	1178	445 100	193 392	445 100	991	427	193 392	0434	187
	4	1178	445 165	193 421	445 165	991	449	193 421	0412	187
	5	1178	445 207	193 439	445 207	991	474	193 439	0387	187
	6	1178	445 224	193 446	445 224	991	495	193 447	0366	187
	7	-1178	-445 224	-193 446	+445 224	-991	-506	+193 447	-0356	-187
	8	1178	445 220	193 445	445 220	991	502	193 445	0360	187
	9	1178	445 230	193 449	445 230	991	484	193 450	0378	187
	10	1178	445 266	193 465	445 266	991	457	193 465	0404	187
	11	1179	445 329	193 492	445 329	992	430	193 492	0432	187
	12	1179	445 415	193 530	445 415	992	408	193 530	0454	187
	13	-1180	-445 512	-193 572	+445 512	-992	-396	+193 572	-0466	-187
	14	1180	445 609	193 614	445 609	993	394	193 614	0469	187
	15	1181	445 696	193 652	445 696	993	401	193 651	0462	188
	16	1181	445 767	193 682	445 767	994	414	193 682	0449	188
	17	1181	445 819	193 705	445 819	994	430	193 705	0434	188
	18	1182	445 853	193 720	445 853	994	444	193 720	0419	188
	19	-1182	-445 872	-193 728	+445 872	-994	-455	+193 728	-0409	-188
	20	1182	445 880	193 732	445 880	994	460	193 732	0404	188
	21	1182	445 885	193 734	445 885	994	457	193 734	0407	188
	22	1182	445 893	193 737	445 893	994	446	193 737	0418	188
	23	1182	445 909	193 744	445 909	994	429	193 744	0435	188
	24	1182	445 940	193 758	445 940	994	406	193 758	0458	188
	25	-1182	-445 989	-193 779	+445 989	-995	-382	+193 779	-0483	-188
	26	1183	446 056	193 808	446 056	995	358	193 808	0506	188
	27	1183	446 141	193 845	446 141	995	339	193 845	0526	188
	28	1184	446 237	193 887	446 237	996	328	193 886	0537	188
	29	1184	446 338	193 931	446 338	996	326	193 930	0540	188
	30	1185	446 434	193 972	446 434	997	333	193 972	0533	188
May	1	-1185	-446 516	-194 008	+446 517	-997	-348	+194 008	-0518	-188
	2	1185	446 579	194 035	446 579	997	368	194 035	0499	188
	3	1186	446 618	194 052	446 618	997	386	194 052	0481	188
	4	1186	446 638	194 061	446 639	997	396	194 061	0470	188
	5	1186	446 650	194 066	446 650	997	395	194 066	0472	188
	6	1186	446 668	194 074	446 668	998	379	194 074	0488	188
	7	-1186	-446 707	-194 091	+446 707	-998	-353	+194 091	-0514	-188
	8	1186	446 774	194 120	446 775	998	322	194 120	0545	188
	9	1187	446 870	194 162	446 870	998	294	194 161	0574	188
	10	1188	446 983	194 211	446 984	999	274	194 210	0594	189
	11	1188	447 102	194 263	447 103	1000	266	194 262	0602	189
	12	1189	447 215	194 311	447 215	1000	269	194 311	0600	189
	13	-1189	-447 311	-194 353	+447 312	-1000	-280	+194 353	-0590	-189
	14	1190	447 388	194 387	447 389	1001	295	194 386	0575	189
	15	1190	447 445	194 412	447 446	1001	310	194 411	0560	189
	16	1190	447 486	194 429	447 486	1001	322	194 429	0548	189
	17	-1190	-447 514	-194 441	+447 514	-1001	-328	+194 441	-0542	-189

Values are in units of 10^{-8}

POSITION AND VELOCITY OF THE EARTH, 2020
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
May	17	-0.566 337 74	-0.765 341 49	-0.331 709 65	+1402 0944	-883 0822	-382 7839
	18	0.552 236 44	0.774 061 53	0.335 489 54	1418 0968	860 8828	373 1753
	19	0.537 977 20	0.782 558 28	0.339 172 78	1433 6812	838 4237	363 4537
	20	0.523 564 24	0.790 829 16	0.342 758 25	1448 8381	815 7121	353 6219
	21	0.509 001 89	0.798 871 70	0.346 244 86	1463 5582	792 7562	343 6827
	22	0.494 294 56	0.806 683 50	0.349 631 55	1477 8328	769 5653	333 6397
	23	-0.479 446 75	-0.814 262 26	-0.352 917 32	+1491 6533	-746 1496	-323 4967
	24	0.464 463 04	0.821 605 78	0.356 101 17	1505 0116	722 5204	313 2582
	25	0.449 348 08	0.828 712 00	0.359 182 18	1517 9007	698 6903	302 9293
	26	0.434 106 61	0.835 578 96	0.362 159 47	1530 3152	674 6727	292 5155
	27	0.418 743 37	0.842 204 87	0.365 032 23	1542 2513	650 4819	282 0231
	28	0.403 263 18	0.848 588 07	0.367 799 69	1553 7070	626 1325	271 4582
	29	-0.387 670 83	-0.854 727 04	-0.370 461 17	+1564 6828	-601 6390	-260 8278
	30	0.371 971 12	0.860 620 42	0.373 016 05	1575 1817	577 0157	250 1383
	31	0.356 168 77	0.866 266 97	0.375 463 76	1585 2086	552 2754	239 3963
June	1	0.340 268 49	0.871 665 58	0.377 803 82	1594 7714	527 4294	228 6076
	2	0.324 274 86	0.876 815 23	0.380 035 78	1603 8794	502 4863	217 7770
	3	0.308 192 39	0.881 715 00	0.382 159 23	1612 5426	477 4511	206 9082
	4	-0.292 025 46	-0.886 363 96	-0.384 173 82	+1620 7712	-452 3258	-196 0029
	5	0.275 778 39	0.890 761 20	0.386 079 17	1628 5727	427 1085	185 0615
	6	0.259 455 41	0.894 905 81	0.387 874 93	1635 9512	401 7956	174 0828
	7	0.243 060 77	0.898 796 78	0.389 560 70	1642 9074	376 3829	163 0654
	8	0.226 598 69	0.902 433 12	0.391 136 10	1649 4377	350 8666	152 0072
	9	0.210 073 46	0.905 813 77	0.392 600 70	1655 5358	325 2452	140 9073
	10	-0.193 489 44	-0.908 937 68	-0.393 954 10	+1661 1940	-299 5197	-129 7652
	11	0.176 851 07	0.911 803 82	0.395 195 87	1666 4039	273 6930	118 5816
	12	0.160 162 88	0.914 411 21	0.396 325 60	1671 1574	247 7698	107 3579
	13	0.143 429 47	0.916 758 92	0.397 342 90	1675 4472	221 7566	96 0961
	14	0.126 655 51	0.918 846 07	0.398 247 40	1679 2662	195 6603	84 7985
	15	0.109 845 74	0.920 671 87	0.399 038 76	1682 6080	169 4884	73 4681
	16	-0.093 004 96	-0.922 235 61	-0.399 716 66	+1685 4670	-143 2493	-62 1076
	17	0.076 138 03	0.923 536 66	0.400 280 82	1687 8370	116 9514	50 7204
	18	0.059 249 86	0.924 574 48	0.400 730 99	1689 7124	90 6041	39 3100
	19	0.042 345 44	0.925 348 61	0.401 066 96	1691 0878	64 2176	27 8801
	20	0.025 429 79	0.925 858 73	0.401 288 55	1691 9579	37 8030	16 4354
	21	-0.008 507 99	0.926 104 62	0.401 395 63	1692 3179	-11 3731	-4 9806
	22	+0.008 414 86	-0.926 086 19	-0.401 388 14	+1692 1649	+15 0584	+6 4786
	23	0.025 333 60	0.925 803 50	0.401 266 07	1691 4972	41 4766	17 9358
	24	0.042 243 09	0.925 256 75	0.401 029 46	1690 3158	67 8661	29 3842
	25	0.059 138 21	0.924 446 32	0.400 678 44	1688 6243	94 2114	40 8169
	26	0.076 013 90	0.923 372 72	0.400 213 20	1686 4288	120 4982	52 2270
	27	0.092 865 14	0.922 036 60	0.399 634 00	1683 7379	146 7132	63 6079
	28	+0.109 687 04	-0.920 438 73	-0.398 941 15	+1680 5622	+172 8457	+74 9541
	29	0.126 474 81	0.918 579 99	0.398 135 05	1676 9136	198 8872	86 2606
	30	0.143 223 77	0.916 461 31	0.397 216 09	1672 8045	224 8324	97 5243
July	1	0.159 929 40	0.914 083 67	0.396 184 71	1668 2464	250 6786	108 7426
	2	+0.176 587 24	-0.911 448 07	-0.395 041 39	+1663 2500	+276 4257	+119 9147

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2020
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
May	17	-1190	-447 514	-194 441	+447 514	-1001	-328	+194 441	-0542	-189
	18	1191	447 536	194 451	447 536	1001	328	194 451	0542	189
	19	1191	447 559	194 461	447 559	1002	320	194 461	0551	189
	20	1191	447 589	194 474	447 589	1002	304	194 474	0566	189
	21	1191	447 633	194 493	447 633	1002	284	194 493	0587	189
	22	1191	447 693	194 520	447 694	1002	260	194 519	0611	189
	23	-1192	-447 774	-194 554	+447 774	-1003	-237	+194 554	-0634	-189
	24	1192	447 872	194 597	447 872	1003	218	194 596	0653	189
	25	1193	447 983	194 646	447 984	1003	206	194 645	0666	189
	26	1194	448 101	194 697	448 101	1004	204	194 695	0668	190
	27	1194	448 215	194 746	448 216	1004	212	194 745	0661	190
	28	1195	448 317	194 790	448 317	1005	228	194 789	0645	190
	29	-1195	-448 400	-194 826	+448 400	-1005	-250	+194 825	-0624	-190
	30	1195	448 459	194 852	448 460	1006	271	194 851	0603	190
	31	1196	448 499	194 870	448 500	1006	287	194 869	0587	190
June	1	1196	448 528	194 882	448 528	1006	292	194 881	0582	190
	2	1196	448 557	194 894	448 557	1006	286	194 894	0589	190
	3	1196	448 600	194 913	448 601	1006	267	194 913	0607	190
	4	-1197	-448 669	-194 943	+448 669	-1007	-242	+194 942	-0632	-190
	5	1197	448 766	194 986	448 767	1007	217	194 985	0658	190
	6	1198	448 887	195 038	448 887	1008	198	195 037	0677	190
	7	1198	449 019	195 095	449 019	1008	190	195 094	0686	190
	8	1199	449 150	195 152	449 150	1009	194	195 151	0682	190
	9	1200	449 268	195 203	449 269	1009	208	195 202	0669	191
	10	-1200	-449 367	-195 246	+449 367	-1010	-228	+195 245	-0649	-191
	11	1201	449 444	195 280	449 445	1010	250	195 279	0628	191
	12	1201	449 502	195 305	449 502	1010	270	195 304	0608	191
	13	1201	449 544	195 323	449 545	1010	285	195 323	0593	191
	14	1201	449 578	195 338	449 578	1011	294	195 337	0585	191
	15	1202	449 610	195 352	449 610	1011	294	195 351	0584	191
	16	-1202	-449 647	-195 368	+449 647	-1011	-288	+195 367	-0591	-191
	17	1202	449 695	195 389	449 695	1011	275	195 388	0603	191
	18	1202	449 759	195 417	449 759	1011	259	195 416	0620	191
	19	1203	449 842	195 453	449 842	1012	243	195 452	0637	191
	20	1203	449 943	195 497	449 944	1012	229	195 496	0651	191
	21	1204	450 060	195 547	450 061	1013	222	195 546	0658	191
	22	-1205	-450 185	-195 602	+450 186	-1013	-224	+195 601	-0656	-191
	23	1205	450 310	195 656	450 310	1014	237	195 655	0644	191
	24	1206	450 423	195 705	450 423	1014	259	195 704	0622	192
	25	1206	450 516	195 745	450 516	1015	288	195 745	0594	192
	26	1207	450 586	195 776	450 586	1015	318	195 775	0564	192
	27	1207	450 634	195 796	450 634	1015	343	195 796	0539	192
	28	-1207	-450 667	-195 811	+450 667	-1016	-359	+195 811	-0524	-192
	29	1207	450 698	195 824	450 698	1016	363	195 824	0519	192
	30	1208	450 739	195 842	450 739	1016	356	195 842	0527	192
July	1	1208	450 800	195 869	450 801	1016	341	195 868	0542	192
	2	-1208	-450 888	-195 907	+450 888	-1017	-324	+195 906	-0559	-192

Values are in units of 10^{-8}

POSITION AND VELOCITY OF THE EARTH, 2020
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
July	1	+0.159 929 40	-0.914 083 67	-0.396 184 71	+1668 2464	+250 6786	+108 7426
	2	0.176 587 24	0.911 448 07	0.395 041 39	1663 2500	276 4257	119 9147
	3	0.193 192 96	0.908 555 48	0.393 786 57	1657 8232	302 0757	131 0408
	4	0.209 742 29	0.905 406 87	0.392 420 72	1651 9712	327 6320	142 1221
	5	0.226 230 98	0.902 003 14	0.390 944 28	1645 6957	353 0979	153 1600
	6	0.242 654 79	0.898 345 20	0.389 357 66	1638 9955	378 4758	164 1558
	7	+0.259 009 46	-0.894 433 92	-0.387 661 30	+1631 8672	+403 7661	+175 1103
	8	0.275 290 69	0.890 270 18	0.385 855 59	1624 3060	428 9676	186 0236
	9	0.291 494 12	0.885 854 88	0.383 940 96	1616 3067	454 0768	196 8950
	10	0.307 615 34	0.881 188 97	0.381 917 84	1607 8642	479 0883	207 7230
	11	0.323 649 91	0.876 273 46	0.379 786 66	1598 9742	503 9959	218 5052
	12	0.339 593 32	0.871 109 42	0.377 547 89	1589 6330	528 7922	229 2393
	13	+0.355 441 06	-0.865 698 01	-0.375 202 04	+1579 8372	+553 4692	+239 9223
	14	0.371 188 55	0.860 040 46	0.372 749 63	1569 5846	578 0189	250 5513
	15	0.386 831 22	0.854 138 09	0.370 191 21	1558 8725	602 4322	261 1229
	16	0.402 364 46	0.847 992 30	0.367 527 37	1547 6985	626 7000	271 6334
	17	0.417 783 64	0.841 604 61	0.364 758 75	1536 0607	650 8122	282 0793
	18	0.433 084 12	0.834 976 61	0.361 886 02	1523 9569	674 7575	292 4560
	19	+0.448 261 22	-0.828 110 05	-0.358 909 88	+1511 3862	+698 5235	+302 7584
	20	0.463 310 28	0.821 006 79	0.355 831 12	1498 3489	722 0961	312 9808
	21	0.478 226 65	0.813 668 82	0.352 650 55	1484 8474	745 4604	323 1167
	22	0.493 005 70	0.806 098 33	0.349 369 09	1470 8869	768 6007	333 1592
	23	0.507 642 89	0.798 297 61	0.345 987 71	1456 4764	791 5020	343 1011
	24	0.522 133 77	0.790 269 13	0.342 507 43	1441 6272	814 1511	352 9359
	25	+0.536 474 02	-0.782 015 46	-0.338 929 37	+1426 3538	+836 5369	+362 6578
	26	0.550 659 48	0.773 539 29	0.335 254 66	1410 6717	858 6521	372 2624
	27	0.564 686 14	0.764 843 34	0.331 484 52	1394 5964	880 4923	381 7465
	28	0.578 550 15	0.755 930 37	0.327 620 14	1378 1426	902 0558	391 1086
	29	0.592 247 78	0.746 803 14	0.323 662 76	1361 3232	923 3436	400 3480
	30	0.605 775 43	0.737 464 41	0.319 613 59	1344 1488	944 3583	409 4654
	31	+0.619 129 59	-0.727 916 88	-0.315 473 85	+1326 6273	+965 1032	+418 4620
Aug.	1	0.632 306 84	0.718 163 23	0.311 244 75	1308 7643	985 5817	427 3391
	2	0.645 303 75	0.708 206 12	0.306 927 46	1290 5624	1005 7970	436 0981
	3	0.658 116 96	0.698 048 16	0.302 523 17	1272 0225	1025 7511	444 7406
	4	0.670 743 07	0.687 691 97	0.298 033 04	1253 1437	1045 4442	453 2671
	5	0.683 178 69	0.677 140 15	0.293 458 22	1233 9242	1064 8750	461 6778
	6	+0.695 420 41	-0.666 395 35	-0.288 799 87	+1214 3623	+1084 0406	+469 9721
	7	0.707 464 79	0.655 460 24	0.284 059 17	1194 4555	1102 9364	478 1487
	8	0.719 308 37	0.644 337 54	0.279 237 29	1174 2028	1121 5567	486 2058
	9	0.730 947 69	0.633 030 04	0.274 335 45	1153 6035	1139 8952	494 1413
	10	0.742 379 28	0.621 540 60	0.269 354 88	1132 6573	1157 9447	501 9526
	11	0.753 599 68	0.609 872 14	0.264 296 83	1111 3647	1175 6976	509 6369
	12	+0.764 605 43	-0.598 027 66	-0.259 162 58	+1089 7266	+1193 1464	+517 1912
	13	0.775 393 06	0.586 010 25	0.253 953 45	1067 7436	1210 2826	524 6126
	14	0.785 959 15	0.573 823 08	0.248 670 78	1045 4171	1227 0973	531 8974
	15	0.796 300 27	0.561 469 41	0.243 315 97	1022 7486	1243 5803	539 0417
	16	+0.806 412 99	-0.548 952 62	-0.237 890 43	+999 7400	+1259 7202	+546 0409

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2020
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
July	1	-1208	-450 800	-195 869	+450 801	-1016	-341	+195 868	-0542	-192
	2	1208	450 888	195 907	450 888	1017	324	195 906	0559	192
	3	1209	450 999	195 955	451 000	1017	311	195 955	0573	192
	4	1210	451 127	196 011	451 127	1018	307	196 010	0577	192
	5	1210	451 258	196 068	451 258	1018	314	196 067	0571	192
	6	1211	451 381	196 121	451 381	1019	332	196 120	0553	192
	7	-1212	-451 487	-196 167	+451 487	-1019	-359	+196 166	-0527	-192
	8	1212	451 571	196 203	451 571	1020	388	196 203	0498	192
	9	1212	451 633	196 230	451 633	1020	418	196 230	0468	193
	10	1213	451 677	196 249	451 677	1020	443	196 249	0443	193
	11	1213	451 710	196 264	451 710	1020	462	196 264	0425	193
	12	1213	451 738	196 276	451 738	1020	473	196 276	0414	193
	13	-1213	-451 768	-196 289	+451 768	-1020	-477	+196 289	-0410	-193
	14	1213	451 806	196 306	451 806	1021	473	196 306	0413	193
	15	1214	451 859	196 329	451 859	1021	466	196 329	0421	193
	16	1214	451 929	196 359	451 929	1021	456	196 359	0431	193
	17	1214	452 018	196 398	452 018	1022	449	196 398	0439	193
	18	1215	452 123	196 443	452 123	1022	446	196 443	0442	193
	19	-1216	-452 240	-196 494	+452 240	-1023	-452	+196 494	-0436	-193
	20	1216	452 359	196 546	452 359	1023	469	196 546	0420	193
	21	1217	452 470	196 594	452 470	1024	495	196 594	0394	193
	22	1217	452 563	196 634	452 563	1024	530	196 635	0360	193
	23	1218	452 632	196 664	452 632	1024	567	196 665	0323	193
	24	1218	452 675	196 683	452 675	1025	601	196 684	0289	193
	25	-1218	-452 701	-196 694	+452 701	-1025	-627	+196 695	-0264	-193
	26	1218	452 721	196 703	452 720	1025	640	196 704	0251	193
	27	1218	452 747	196 714	452 747	1025	641	196 715	0250	193
	28	1219	452 792	196 734	452 792	1025	633	196 735	0258	194
	29	1219	452 861	196 764	452 860	1025	621	196 764	0270	194
	30	1219	452 953	196 804	452 952	1026	613	196 804	0279	194
	31	-1220	-453 062	-196 851	+453 062	-1026	-611	+196 852	-0281	-194
Aug.	1	1221	453 178	196 901	453 177	1027	620	196 902	0272	194
	2	1221	453 289	196 949	453 288	1027	639	196 950	0253	194
	3	1222	453 386	196 992	453 385	1028	668	196 993	0225	194
	4	1222	453 463	197 025	453 462	1028	701	197 026	0193	194
	5	1223	453 517	197 049	453 517	1028	735	197 050	0159	194
	6	-1223	-453 552	-197 064	+453 552	-1029	-766	+197 065	-0128	-194
	7	1223	453 573	197 073	453 573	1029	790	197 075	0103	194
	8	1223	453 587	197 079	453 586	1029	807	197 081	0086	194
	9	1223	453 600	197 085	453 600	1029	816	197 087	0078	194
	10	1223	453 620	197 094	453 619	1029	818	197 095	0076	194
	11	1223	453 652	197 108	453 651	1029	814	197 109	0080	194
	12	-1224	-453 700	-197 128	+453 699	-1029	-808	+197 130	-0087	-194
	13	1224	453 766	197 157	453 765	1030	801	197 158	0093	194
	14	1224	453 849	197 193	453 848	1030	799	197 194	0096	194
	15	1225	453 945	197 235	453 944	1030	803	197 236	0092	195
	16	-1225	-454 048	-197 279	+454 047	-1031	-817	+197 281	-0079	-195

Values are in units of 10^{-8}

POSITION AND VELOCITY OF THE EARTH, 2020
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
Aug.	16	+0.806 412 99	-0.548 952 62	-0.237 890 43	+999 7400	+1259 7202	+546 0409
	17	0.816 293 95	0.536 276 19	0.232 395 65	976 3952	1275 5045	552 8897
	18	0.825 939 79	0.523 443 76	0.226 833 16	952 7201	1290 9191	559 5819
	19	0.835 347 28	0.510 459 09	0.221 204 55	928 7240	1305 9498	566 1111
	20	0.844 513 25	0.497 326 09	0.215 511 50	904 4199	1320 5831	572 4706
	21	0.853 434 70	0.484 048 79	0.209 755 73	879 8247	1334 8079	578 6545
	22	+0.862 108 83	-0.470 631 32	-0.203 939 01	+854 9571	+1348 6166	+584 6584
	23	0.870 533 01	0.457 077 86	0.198 063 17	829 8370	1362 0058	590 4795
	24	0.878 704 79	0.443 392 60	0.192 130 04	804 4832	1374 9761	596 1166
	25	0.886 621 94	0.429 579 72	0.186 141 45	778 9119	1387 5308	601 5707
	26	0.894 282 35	0.415 643 35	0.180 099 23	753 1365	1399 6751	606 8432
	27	0.901 684 03	0.401 587 57	0.174 005 18	727 1674	1411 4148	611 9362
	28	+0.908 825 08	-0.387 416 39	-0.167 861 09	+701 0117	+1422 7553	+616 8523
	29	0.915 703 66	0.373 133 78	0.161 668 72	674 6752	1433 7013	621 5938
	30	0.922 317 99	0.358 743 66	0.155 429 79	648 1612	1444 2567	626 1626
	31	0.928 666 30	0.344 249 94	0.149 146 04	621 4718	1454 4237	630 5602
Sept.	1	0.934 746 85	0.329 656 48	0.142 819 16	594 6085	1464 2034	634 7878
	2	0.940 557 89	0.314 967 16	0.136 450 85	567 5721	1473 5957	638 8460
	3	+0.946 097 71	-0.300 185 86	-0.130 042 80	+540 3632	+1482 5990	+642 7346
	4	0.951 364 58	0.285 316 49	0.123 596 72	512 9826	1491 2103	646 4532
	5	0.956 356 80	0.270 362 98	0.117 114 31	485 4316	1499 4260	650 0008
	6	0.961 072 66	0.255 329 30	0.110 597 28	457 7121	1507 2413	653 3758
	7	0.965 510 49	0.240 219 50	0.104 047 37	429 8265	1514 6515	656 5766
	8	0.969 668 64	0.225 037 64	0.097 466 34	401 7776	1521 6510	659 6013
	9	+0.973 545 51	-0.209 787 87	-0.090 855 94	+373 5690	+1528 2337	+662 4478
	10	0.977 139 50	0.194 474 38	0.084 217 98	345 2042	1534 3933	665 1135
	11	0.980 449 08	0.179 101 44	0.077 554 28	316 6872	1540 1230	667 5959
	12	0.983 472 75	0.163 673 38	0.070 866 69	288 0225	1545 4151	669 8919
	13	0.986 209 06	0.148 194 62	0.064 157 08	259 2154	1550 2607	671 9978
	14	0.988 656 61	0.132 669 69	0.057 427 38	230 2726	1554 6495	673 9094
	15	+0.990 814 09	-0.117 103 19	-0.050 679 55	+201 2028	+1558 5708	+675 6216
	16	0.992 680 28	0.101 499 87	0.043 915 63	172 0185	1562 0130	677 1291
	17	0.994 254 13	0.085 864 56	0.037 137 67	142 7358	1564 9657	678 4263
	18	0.995 534 74	0.070 202 21	0.030 347 82	113 3748	1567 4212	679 5088
	19	0.996 521 44	0.054 517 81	0.023 548 22	83 9581	1569 3763	680 3737
	20	0.997 213 79	0.038 816 35	0.016 741 07	54 5082	1570 8324	681 0203
	21	+0.997 611 56	-0.023 102 80	-0.009 928 54	+25 0459	+1571 7955	+681 4502
	22	0.997 714 72	-0.007 382 05	-0.003 112 78	-4 4117	1572 2747	681 6663
	23	0.997 523 39	+0.008 341 11	+0.003 704 09	33 8518	1572 2799	681 6729
	24	0.997 037 78	0.024 062 00	0.010 520 00	63 2651	1571 8210	681 4742
	25	0.996 258 20	0.039 776 01	0.017 332 90	92 6452	1570 9064	681 0740
	26	0.995 185 00	0.055 478 63	0.024 140 82	121 9877	1569 5431	680 4761
	27	+0.993 818 58	+0.071 165 40	+0.030 941 78	-151 2893	+1567 7366	+679 6833
	28	0.992 159 36	0.086 831 90	0.037 733 84	180 5472	1565 4910	678 6980
	29	0.990 207 79	0.102 473 76	0.044 515 10	209 7589	1562 8090	677 5221
	30	0.987 964 34	0.118 086 63	0.051 283 65	238 9222	1559 6925	676 1570
Oct.	1	+0.985 429 51	+0.133 666 17	+0.058 037 61	-268 0347	+1556 1424	+674 6038

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2020
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
Aug.	16	-1225	-454 048	-197 279	+454 047	-1031	-817	+197 281	-0079	-195
	17	1226	454 147	197 322	454 146	1031	841	197 324	0055	195
	18	1226	454 233	197 360	454 232	1032	874	197 361	-0022	195
	19	1227	454 295	197 387	454 294	1032	913	197 389	+0016	195
	20	1227	454 331	197 402	454 330	1032	950	197 405	0053	195
	21	1227	454 345	197 409	454 344	1032	979	197 411	0082	195
	22	-1227	-454 348	-197 410	+454 347	-1032	-996	+197 412	+0099	-195
	23	1227	454 355	197 413	454 354	1032	999	197 415	0102	195
	24	1227	454 378	197 423	454 377	1032	991	197 426	0094	195
	25	1227	454 426	197 444	454 425	1033	979	197 446	0082	195
	26	1228	454 498	197 475	454 497	1033	967	197 477	0070	195
	27	1228	454 588	197 514	454 587	1033	962	197 516	0064	195
	28	-1229	-454 686	-197 557	+454 685	-1034	-967	+197 559	+0069	-195
	29	1229	454 782	197 598	454 781	1034	982	197 601	0083	195
	30	1230	454 866	197 635	454 865	1035	1006	197 637	0107	195
	31	1230	454 932	197 663	454 931	1035	1035	197 666	0136	195
Sept.	1	1230	454 977	197 683	454 975	1035	1066	197 686	0167	195
	2	1231	455 001	197 694	455 000	1035	1095	197 697	0195	195
	3	-1231	-455 010	-197 698	+455 009	-1035	-1118	+197 701	+0218	-195
	4	1231	455 010	197 698	455 009	1035	1134	197 701	0234	195
	5	1231	455 008	197 697	455 006	1035	1141	197 700	0241	195
	6	1231	455 011	197 698	455 009	1035	1140	197 701	0241	195
	7	1231	455 024	197 704	455 023	1035	1134	197 707	0234	195
	8	1231	455 053	197 716	455 052	1035	1123	197 719	0223	195
	9	-1231	-455 099	-197 736	+455 098	-1036	-1112	+197 739	+0212	-196
	10	1231	455 162	197 764	455 161	1036	1103	197 767	0202	196
	11	1232	455 240	197 797	455 238	1036	1099	197 800	0198	196
	12	1232	455 326	197 835	455 325	1037	1103	197 838	0203	196
	13	1233	455 414	197 873	455 413	1037	1118	197 876	0217	196
	14	1233	455 493	197 908	455 492	1037	1142	197 911	0240	196
	15	-1234	-455 555	-197 934	+455 553	-1038	-1172	+197 938	+0271	-196
	16	1234	455 591	197 950	455 590	1038	1205	197 954	0303	196
	17	1234	455 603	197 955	455 601	1038	1232	197 959	0330	196
	18	1234	455 598	197 953	455 597	1038	1248	197 957	0346	196
	19	1234	455 592	197 951	455 590	1038	1249	197 954	0347	196
	20	1234	455 600	197 954	455 598	1038	1237	197 958	0335	196
	21	-1234	-455 633	-197 968	+455 631	-1038	-1217	+197 972	+0315	-196
	22	1234	455 693	197 995	455 692	1038	1196	197 998	0294	196
	23	1235	455 775	198 030	455 774	1039	1181	198 034	0279	196
	24	1235	455 869	198 071	455 867	1039	1176	198 074	0273	196
	25	1236	455 962	198 111	455 960	1040	1181	198 115	0277	196
	26	1236	456 044	198 147	456 042	1040	1195	198 150	0292	196
	27	-1237	-456 109	-198 175	+456 107	-1040	-1216	+198 179	+0312	-196
	28	1237	456 153	198 195	456 152	1040	1239	198 198	0335	196
	29	1237	456 178	198 205	456 176	1040	1260	198 209	0356	196
	30	1237	456 186	198 209	456 185	1041	1277	198 213	0373	196
Oct.	1	-1237	-456 185	-198 208	+456 183	-1041	-1286	+198 212	+0382	-196

Values are in units of 10^{-8}

POSITION AND VELOCITY OF THE EARTH, 2020
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
Oct.	1	+0.985 429 51	+0.133 666 17	+0.058 037 61	-268 0347	+1556 1424	+674 6038
	2	0.982 603 82	0.149 208 03	0.064 775 10	297 0940	1552 1587	672 8628
	3	0.979 487 82	0.164 707 89	0.071 494 25	326 0971	1547 7405	670 9346
	4	0.976 082 08	0.180 161 39	0.078 193 17	355 0407	1542 8862	668 8188
	5	0.972 387 22	0.195 564 16	0.084 870 00	383 9213	1537 5939	666 5151
	6	0.968 403 88	0.210 911 80	0.091 522 84	412 7346	1531 8609	664 0227
	7	+0.964 132 77	+0.226 199 90	+0.098 149 82	-441 4756	+1525 6843	+661 3406
	8	0.959 574 63	0.241 424 00	0.104 749 02	470 1393	1519 0608	658 4679
	9	0.954 730 26	0.256 579 61	0.111 318 53	498 7198	1511 9865	655 4027
	10	0.949 600 53	0.271 662 21	0.117 856 43	527 2106	1504 4569	652 1435
	11	0.944 186 37	0.286 667 21	0.124 360 75	555 6047	1496 4666	648 6882
	12	0.938 488 79	0.301 589 99	0.130 829 53	583 8932	1488 0098	645 0338
	13	+0.932 508 89	+0.316 425 83	+0.137 260 75	-612 0654	+1479 0795	+641 1770
	14	0.926 247 91	0.331 169 98	0.143 652 38	640 1072	1469 6692	637 1143
	15	0.919 707 24	0.345 817 59	0.150 002 34	668 0014	1459 7730	632 8423
	16	0.912 888 44	0.360 363 81	0.156 308 52	695 7271	1449 3881	628 3585
	17	0.905 793 34	0.374 803 73	0.162 568 80	723 2606	1438 5163	623 6621
	18	0.898 423 95	0.389 132 53	0.168 781 06	750 5790	1427 1643	618 7548
	19	+0.890 782 54	+0.403 345 46	+0.174 943 21	-777 6616	+1415 3435	+613 6403
	20	0.882 871 56	0.417 437 89	0.181 053 20	804 4920	1403 0687	608 3244
	21	0.874 693 58	0.431 405 37	0.187 109 05	831 0590	1390 3550	602 8139
	22	0.866 251 28	0.445 243 57	0.193 108 85	857 3558	1377 2168	597 1152
	23	0.857 547 38	0.458 948 33	0.199 050 74	883 3786	1363 6663	591 2341
	24	0.848 584 63	0.472 515 56	0.204 932 94	909 1249	1349 7134	585 1755
	25	+0.839 365 81	+0.485 941 28	+0.210 753 68	-934 5932	+1335 3664	+578 9439
	26	0.829 893 70	0.499 221 60	0.216 511 25	959 7820	1320 6319	572 5428
	27	0.820 171 10	0.512 352 65	0.222 203 98	984 6898	1305 5150	565 9753
	28	0.810 200 85	0.525 330 64	0.227 830 21	1009 3142	1290 0207	559 2438
	29	0.799 985 77	0.538 151 82	0.233 388 32	1033 6536	1274 1527	552 3507
	30	0.789 528 73	0.550 812 46	0.238 876 69	1057 7057	1257 9143	545 2981
	31	+0.778 832 62	+0.563 308 88	+0.244 293 75	-1081 4678	+1241 3083	+538 0875
Nov.	1	0.767 900 35	0.575 637 41	0.249 637 92	1104 9373	1224 3368	530 7205
	2	0.756 734 86	0.587 794 40	0.254 907 64	1128 1114	1207 0012	523 1979
	3	0.745 339 12	0.599 776 22	0.260 101 36	1150 9863	1189 3024	515 5207
	4	0.733 716 15	0.611 579 24	0.265 217 54	1173 5580	1171 2410	507 6892
	5	0.721 868 99	0.623 199 83	0.270 254 64	1195 8219	1152 8167	499 7036
	6	+0.709 800 75	+0.634 634 36	+0.275 211 10	-1217 7723	+1134 0289	+491 5639
	7	0.697 514 61	0.645 879 20	0.280 085 40	1239 4029	1114 8771	483 2694
	8	0.685 013 79	0.656 930 68	0.284 875 97	1260 7060	1095 3597	474 8196
	9	0.672 301 61	0.667 785 17	0.289 581 27	1281 6729	1075 4752	466 2136
	10	0.659 381 48	0.678 438 96	0.294 199 72	1302 2927	1055 2219	457 4499
	11	0.646 256 95	0.688 888 37	0.298 729 74	1322 5519	1034 5984	448 5273
	12	+0.632 931 70	+0.699 129 69	+0.303 169 73	-1342 4343	+1013 6049	+439 4448
	13	0.619 409 59	0.709 159 24	0.307 518 10	1361 9209	992 2444	430 2023
	14	0.605 694 67	0.718 973 38	0.311 773 25	1380 9913	970 5237	420 8016
	15	0.591 791 22	0.728 568 55	0.315 933 62	1399 6252	948 4544	411 2463
	16	+0.577 703 68	+0.737 941 36	+0.319 997 68	-1417 8049	+926 0529	+401 5426

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2020
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
Oct.	1	-1237	-456 185	-198 208	+456 183	-1041	-1286	+198 212	+0382	-196
	2	1237	456 180	198 206	456 178	1041	1288	198 210	0383	196
	3	1237	456 179	198 206	456 177	1041	1281	198 210	0376	196
	4	1237	456 187	198 210	456 186	1041	1267	198 213	0363	196
	5	1237	456 211	198 220	456 209	1041	1248	198 224	0344	196
	6	1237	456 252	198 238	456 250	1041	1228	198 241	0324	196
	7	-1238	-456 310	-198 263	+456 309	-1041	-1210	+198 267	+0305	-197
	8	1238	456 384	198 295	456 382	1041	1196	198 298	0291	197
	9	1239	456 468	198 332	456 467	1042	1190	198 335	0284	197
	10	1239	456 556	198 370	456 555	1042	1192	198 373	0286	197
	11	1239	456 639	198 406	456 638	1043	1203	198 409	0297	197
	12	1240	456 710	198 437	456 708	1043	1223	198 440	0316	197
	13	-1240	-456 759	-198 458	+456 758	-1043	-1246	+198 462	+0339	-197
	14	1240	456 786	198 470	456 784	1043	1267	198 473	0361	197
	15	1240	456 792	198 472	456 790	1043	1281	198 476	0374	197
	16	1240	456 790	198 472	456 789	1043	1281	198 476	0374	197
	17	1240	456 796	198 474	456 795	1043	1266	198 478	0359	197
	18	1240	456 826	198 487	456 824	1043	1239	198 491	0332	197
	19	-1241	-456 885	-198 513	+456 884	-1044	-1209	+198 517	+0302	-197
	20	1241	456 973	198 551	456 972	1044	1182	198 555	0275	197
	21	1242	457 079	198 597	457 077	1045	1165	198 600	0257	197
	22	1242	457 187	198 644	457 186	1045	1159	198 647	0251	197
	23	1243	457 287	198 688	457 286	1046	1165	198 691	0256	197
	24	1243	457 370	198 724	457 369	1046	1177	198 727	0269	197
	25	-1244	-457 432	-198 750	+457 431	-1046	-1194	+198 754	+0285	-198
	26	1244	457 473	198 768	457 472	1046	1210	198 772	0300	198
	27	1244	457 497	198 779	457 496	1047	1221	198 782	0312	198
	28	1244	457 510	198 785	457 509	1047	1226	198 788	0317	198
	29	1244	457 518	198 788	457 517	1047	1223	198 792	0314	198
	30	1244	457 529	198 793	457 527	1047	1212	198 796	0302	198
	31	-1244	-457 549	-198 801	+457 547	-1047	-1194	+198 805	+0284	-198
Nov.	1	1245	457 583	198 816	457 581	1047	1170	198 819	0261	198
	2	1245	457 634	198 839	457 633	1047	1145	198 842	0235	198
	3	1245	457 704	198 869	457 703	1047	1120	198 872	0210	198
	4	1246	457 790	198 906	457 788	1048	1100	198 909	0190	198
	5	1246	457 887	198 948	457 886	1048	1087	198 951	0176	198
	6	-1247	-457 990	-198 993	+457 989	-1049	-1082	+198 996	+0171	-198
	7	1247	458 090	199 036	458 089	1049	1087	199 039	0175	198
	8	1248	458 180	199 075	458 178	1050	1099	199 078	0187	198
	9	1248	458 252	199 107	458 250	1050	1117	199 110	0204	198
	10	1248	458 303	199 129	458 301	1050	1135	199 132	0222	198
	11	1249	458 334	199 142	458 332	1050	1148	199 145	0235	198
	12	-1249	-458 352	-199 150	+458 351	-1050	-1151	+199 153	+0238	-198
	13	1249	458 371	199 159	458 370	1051	1140	199 162	0227	198
	14	1249	458 406	199 174	458 405	1051	1116	199 177	0203	198
	15	1249	458 470	199 202	458 469	1051	1084	199 205	0171	198
	16	-1250	-458 567	-199 244	+458 565	-1051	-1053	+199 246	+0139	-198

Values are in units of 10^{-8}

POSITION AND VELOCITY OF THE EARTH, 2020
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
Nov.	16	+0.577 703 68	+0.737 941 36	+0.319 997 68	-1417 8049	+926 0529	+401 5426
	17	0.563 436 68	0.747 088 57	0.323 964 00	1435 5176	903 3380	391 6983
	18	0.548 994 91	0.756 007 14	0.327 831 21	1452 7555	880 3293	381 7218
	19	0.534 383 16	0.764 694 23	0.331 598 02	1469 5157	857 0450	371 6217
	20	0.519 606 19	0.773 147 18	0.335 263 26	1485 7986	833 5011	361 4056
	21	0.504 668 77	0.781 363 43	0.338 825 77	1501 6060	809 7104	351 0799
	22	+0.489 575 65	+0.789 340 60	+0.342 284 51	-1516 9400	+785 6836	+340 6503
	23	0.474 331 54	0.797 076 35	0.345 638 45	1531 8028	761 4297	330 1212
	24	0.458 941 16	0.804 568 46	0.348 886 61	1546 1959	736 9565	319 4969
	25	0.443 409 19	0.811 814 77	0.352 028 08	1560 1202	712 2711	308 7809
	26	0.427 740 31	0.818 813 20	0.355 061 94	1573 5764	687 3800	297 9765
	27	0.411 939 22	0.825 561 71	0.357 987 33	1586 5650	662 2892	287 0872
	28	+0.396 010 57	+0.832 058 33	+0.360 803 41	-1599 0864	+637 0045	+276 1156
	29	0.379 959 05	0.838 301 17	0.363 509 37	1611 1409	611 5309	265 0644
	30	0.363 789 31	0.844 288 34	0.366 104 44	1622 7287	585 8727	253 9361
Dec.	1	0.347 506 03	0.850 018 02	0.368 587 84	1633 8492	560 0337	242 7323
	2	0.331 113 88	0.855 488 42	0.370 958 84	1644 5020	534 0168	231 4546
	3	0.314 617 56	0.860 697 77	0.373 216 69	1654 6850	507 8243	220 1042
	4	+0.298 021 76	+0.865 644 32	+0.375 360 68	-1664 3954	+481 4581	+208 6818
	5	0.281 331 24	0.870 326 36	0.377 390 09	1673 6294	454 9198	197 1880
	6	0.264 550 78	0.874 742 15	0.379 304 20	1682 3810	428 2112	185 6231
	7	0.247 685 25	0.878 890 02	0.381 102 31	1690 6434	401 3338	173 9872
	8	0.230 739 57	0.882 768 27	0.382 783 71	1698 4077	374 2904	162 2811
	9	0.213 718 79	0.886 375 28	0.384 347 70	1705 6631	347 0844	150 5051
	10	+0.196 628 05	+0.889 709 44	+0.385 793 59	-1712 3968	+319 7212	+138 6605
	11	0.179 472 64	0.892 769 21	0.387 120 69	1718 5948	292 2088	126 7497
	12	0.162 257 99	0.895 553 16	0.388 328 37	1724 2424	264 5586	114 7764
	13	0.144 989 67	0.898 059 97	0.389 416 03	1729 3259	236 7857	102 7460
	14	0.127 673 39	0.900 288 52	0.390 383 13	1733 8340	208 9089	90 6661
	15	0.110 314 93	0.902 237 87	0.391 229 21	1737 7597	180 9490	78 5454
	16	+0.092 920 14	+0.903 907 30	+0.391 953 93	-1741 1013	+152 9272	+66 3933
	17	0.075 494 85	0.905 296 28	0.392 557 01	1743 8612	124 8638	54 2191
	18	0.058 044 84	0.906 404 49	0.393 038 27	1746 0451	96 7757	42 0312
	19	0.040 575 84	0.907 231 76	0.393 397 61	1747 6604	68 6775	29 8366
	20	0.023 093 50	0.907 778 05	0.393 635 00	1748 7149	40 5811	17 6415
	21	0.005 603 39	0.908 043 42	0.393 750 46	1749 2158	+12 4961	+5 4510
	22	-0.011 889 00	+0.908 028 04	+0.393 744 05	-1749 1699	-15 5689	-6 7304
	23	0.029 378 21	0.907 732 14	0.393 615 89	1748 5832	43 6060	18 8992
	24	0.046 858 87	0.907 156 03	0.393 366 12	1747 4608	71 6082	31 0513
	25	0.064 325 66	0.906 300 11	0.392 994 93	1745 8081	99 5685	43 1834
	26	0.081 773 29	0.905 164 82	0.392 502 53	1743 6301	127 4803	55 2924
	27	0.099 196 53	0.903 750 68	0.391 889 17	1740 9317	155 3380	67 3752
	28	-0.116 590 20	+0.902 058 26	+0.391 155 12	-1737 7179	-183 1362	-79 4293
	29	0.133 949 18	0.900 088 17	0.390 300 69	1733 9934	210 8707	91 4526
	30	0.151 268 38	0.897 841 07	0.389 326 18	1729 7623	238 5382	103 4435
	31	0.168 542 75	0.895 317 64	0.388 231 93	1725 0273	266 1361	115 4006
	32	-0.185 767 25	+0.892 518 59	+0.387 018 28	-1719 7901	-293 6627	-127 3237

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2020
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
Nov.	16	-1250	-458 567	-199 244	+458 565	-1051	-1053	+199 246	+0139	-198
	17	1251	458 688	199 296	458 687	1052	1029	199 299	0114	199
	18	1251	458 822	199 354	458 821	1053	1017	199 357	0102	199
	19	1252	458 951	199 410	458 950	1053	1018	199 413	0103	199
	20	1253	459 064	199 459	459 063	1054	1029	199 462	0114	199
	21	1253	459 155	199 499	459 154	1054	1046	199 502	0130	199
	22	-1253	-459 223	-199 528	+459 222	-1054	-1064	+199 531	+0147	-199
	23	1254	459 271	199 549	459 270	1055	1078	199 552	0161	199
	24	1254	459 306	199 565	459 305	1055	1086	199 567	0170	199
	25	1254	459 334	199 577	459 333	1055	1087	199 580	0170	199
	26	1254	459 363	199 589	459 361	1055	1079	199 592	0162	199
	27	1254	459 398	199 605	459 397	1055	1064	199 608	0147	199
	28	-1255	-459 447	-199 626	+459 446	-1055	-1044	+199 629	+0127	-199
	29	1255	459 513	199 655	459 512	1056	1021	199 657	0104	199
	30	1256	459 597	199 691	459 596	1056	999	199 694	0081	199
Dec.	1	1256	459 698	199 735	459 697	1057	980	199 737	0062	199
	2	1257	459 812	199 785	459 811	1057	968	199 787	0049	200
	3	1257	459 933	199 837	459 932	1058	965	199 839	0046	200
	4	-1258	-460 052	-199 889	+460 051	-1058	-971	+199 891	+0052	-200
	5	1259	460 162	199 936	460 161	1059	986	199 939	0066	200
	6	1259	460 255	199 977	460 254	1059	1007	199 979	0086	200
	7	1260	460 327	200 008	460 326	1060	1029	200 011	0109	200
	8	1260	460 379	200 030	460 378	1060	1049	200 033	0128	200
	9	1260	460 416	200 047	460 415	1060	1060	200 049	0139	200
	10	-1260	-460 449	-200 061	+460 448	-1060	-1059	+200 064	+0138	-200
	11	1260	460 492	200 080	460 491	1060	1046	200 082	0125	200
	12	1261	460 557	200 108	460 556	1061	1024	200 110	0103	200
	13	1261	460 652	200 149	460 650	1061	998	200 151	0076	200
	14	1262	460 776	200 203	460 775	1062	977	200 205	0054	200
	15	1263	460 919	200 265	460 918	1062	966	200 267	0043	201
	16	-1264	-461 067	-200 329	+461 065	-1063	-969	+200 331	+0045	-201
	17	1264	461 203	200 388	461 202	1064	984	200 391	0059	201
	18	1265	461 318	200 438	461 317	1064	1007	200 441	0082	201
	19	1265	461 408	200 477	461 406	1064	1034	200 480	0109	201
	20	1266	461 474	200 506	461 473	1065	1058	200 509	0133	201
	21	1266	461 523	200 527	461 522	1065	1077	200 530	0152	201
	22	-1266	-461 562	-200 544	+461 560	-1065	-1089	+200 547	+0163	-201
	23	1266	461 598	200 560	461 597	1065	1092	200 563	0167	201
	24	1267	461 639	200 578	461 638	1066	1088	200 581	0162	201
	25	1267	461 691	200 600	461 690	1066	1078	200 603	0152	201
	26	1267	461 759	200 630	461 758	1066	1064	200 632	0138	201
	27	1268	461 844	200 667	461 843	1067	1050	200 669	0123	201
	28	-1268	-461 946	-200 711	+461 945	-1067	-1038	+200 714	+0111	-201
	29	1269	462 063	200 762	462 062	1068	1033	200 764	0105	202
	30	1270	462 188	200 816	462 187	1068	1036	200 819	0108	202
	31	1270	462 313	200 870	462 312	1069	1049	200 873	0121	202
	32	-1271	-462 430	-200 921	+462 429	-1069	-1072	+200 924	+0143	-202

Values are in units of 10^{-8}

APPARENT PLACES OF POLARIS, 2020

FOR 0^h TERRESTRIAL TIME

α Ursae Minoris												Mag. 2.02									Sp. F8v			
	JANUARY						FEBRUARY						MARCH						APRIL					
Date	Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
1	2	57	56	+89	21	04	2	57	02	+89	21	09	2	56	08	+89	21	08	2	55	25	+89	21	01
2	2	57	54	+89	21	04	2	57	01	+89	21	09	2	56	06	+89	21	08	2	55	24	+89	21	01
3	2	57	53	+89	21	04	2	56	59	+89	21	09	2	56	04	+89	21	07	2	55	23	+89	21	01
4	2	57	51	+89	21	05	2	56	57	+89	21	09	2	56	03	+89	21	07	2	55	22	+89	21	01
5	2	57	50	+89	21	05	2	56	55	+89	21	09	2	56	02	+89	21	07	2	55	21	+89	21	00
6	2	57	48	+89	21	05	2	56	54	+89	21	09	2	55	60	+89	21	07	2	55	20	+89	21	00
7	2	57	47	+89	21	05	2	56	52	+89	21	09	2	55	58	+89	21	07	2	55	19	+89	20	60
8	2	57	46	+89	21	05	2	56	50	+89	21	09	2	55	56	+89	21	07	2	55	18	+89	20	60
9	2	57	44	+89	21	06	2	56	48	+89	21	09	2	55	55	+89	21	07	2	55	17	+89	20	59
10	2	57	43	+89	21	06	2	56	46	+89	21	09	2	55	53	+89	21	07	2	55	17	+89	20	59
11	2	57	42	+89	21	06	2	56	44	+89	21	09	2	55	51	+89	21	06	2	55	16	+89	20	59
12	2	57	40	+89	21	06	2	56	41	+89	21	09	2	55	49	+89	21	06	2	55	16	+89	20	58
13	2	57	38	+89	21	07	2	56	39	+89	21	09	2	55	48	+89	21	06	2	55	16	+89	20	58
14	2	57	36	+89	21	07	2	56	37	+89	21	09	2	55	47	+89	21	06	2	55	15	+89	20	58
15	2	57	34	+89	21	07	2	56	36	+89	21	09	2	55	45	+89	21	05	2	55	15	+89	20	58
16	2	57	32	+89	21	07	2	56	34	+89	21	09	2	55	44	+89	21	05	2	55	14	+89	20	57
17	2	57	30	+89	21	07	2	56	32	+89	21	09	2	55	43	+89	21	05	2	55	14	+89	20	57
18	2	57	29	+89	21	07	2	56	31	+89	21	09	2	55	42	+89	21	05	2	55	13	+89	20	57
19	2	57	27	+89	21	07	2	56	29	+89	21	09	2	55	40	+89	21	05	2	55	13	+89	20	56
20	2	57	25	+89	21	08	2	56	27	+89	21	09	2	55	39	+89	21	05	2	55	12	+89	20	56
21	2	57	24	+89	21	08	2	56	25	+89	21	09	2	55	37	+89	21	04	2	55	11	+89	20	56
22	2	57	22	+89	21	08	2	56	23	+89	21	09	2	55	36	+89	21	04	2	55	11	+89	20	55
23	2	57	21	+89	21	08	2	56	21	+89	21	09	2	55	34	+89	21	04	2	55	11	+89	20	55
24	2	57	19	+89	21	08	2	56	19	+89	21	09	2	55	33	+89	21	04	2	55	11	+89	20	55
25	2	57	17	+89	21	08	2	56	17	+89	21	08	2	55	31	+89	21	03	2	55	11	+89	20	54
26	2	57	15	+89	21	08	2	56	15	+89	21	08	2	55	30	+89	21	03	2	55	11	+89	20	54
27	2	57	13	+89	21	09	2	56	13	+89	21	08	2	55	29	+89	21	03	2	55	11	+89	20	54
28	2	57	11	+89	21	09	2	56	11	+89	21	08	2	55	28	+89	21	02	2	55	11	+89	20	53
29	2	57	09	+89	21	09	2	56	9.2	89	21	7.9	2	55	27	+89	21	02	2	55	11	+89	20	53
30	2	57	06	+89	21	09							2	55	26	+89	21	02	2	55	11	+89	20	53
31	2	57	04	+89	21	09							2	55	25	+89	21	02						

APPARENT PLACES OF POLARIS, 2020

FOR 0^h TERRESTRIAL TIME

α Ursae Minoris												Mag. 2.02							Sp. F8v					
	MAY						JUNE						JULY						AUGUST					
Date	Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
1	2	55	11	+89	20	53	2	55	30	+89	20	44	2	56	13	+89	20	39	2	57	14	+89	20	38
2	2	55	11	+89	20	52	2	55	31	+89	20	44	2	56	15	+89	20	39	2	57	16	+89	20	38
3	2	55	11	+89	20	52	2	55	32	+89	20	44	2	56	17	+89	20	38	2	57	18	+89	20	38
4	2	55	11	+89	20	52	2	55	33	+89	20	43	2	56	20	+89	20	38	2	57	20	+89	20	38
5	2	55	11	+89	20	52	2	55	35	+89	20	43	2	56	22	+89	20	38	2	57	22	+89	20	38
6	2	55	11	+89	20	51	2	55	36	+89	20	43	2	56	23	+89	20	38	2	57	24	+89	20	38
7	2	55	12	+89	20	51	2	55	38	+89	20	43	2	56	25	+89	20	38	2	57	25	+89	20	38
8	2	55	12	+89	20	51	2	55	39	+89	20	42	2	56	27	+89	20	38	2	57	27	+89	20	38
9	2	55	13	+89	20	50	2	55	40	+89	20	42	2	56	29	+89	20	38	2	57	29	+89	20	38
10	2	55	14	+89	20	50	2	55	42	+89	20	42	2	56	30	+89	20	38	2	57	31	+89	20	38
11	2	55	14	+89	20	50	2	55	43	+89	20	42	2	56	32	+89	20	38	2	57	33	+89	20	38
12	2	55	15	+89	20	49	2	55	44	+89	20	42	2	56	33	+89	20	38	2	57	35	+89	20	38
13	2	55	15	+89	20	49	2	55	45	+89	20	42	2	56	35	+89	20	38	2	57	38	+89	20	39
14	2	55	16	+89	20	49	2	55	46	+89	20	41	2	56	37	+89	20	38	2	57	40	+89	20	39
15	2	55	16	+89	20	49	2	55	47	+89	20	41	2	56	39	+89	20	38	2	57	42	+89	20	39
16	2	55	16	+89	20	48	2	55	49	+89	20	41	2	56	41	+89	20	38	2	57	44	+89	20	39
17	2	55	17	+89	20	48	2	55	50	+89	20	41	2	56	43	+89	20	37	2	57	46	+89	20	39
18	2	55	17	+89	20	48	2	55	52	+89	20	40	2	56	46	+89	20	37	2	57	48	+89	20	39
19	2	55	18	+89	20	47	2	55	54	+89	20	40	2	56	48	+89	20	37	2	57	50	+89	20	39
20	2	55	18	+89	20	47	2	55	55	+89	20	40	2	56	50	+89	20	37	2	57	52	+89	20	40
21	2	55	19	+89	20	47	2	55	57	+89	20	40	2	56	52	+89	20	37	2	57	54	+89	20	40
22	2	55	20	+89	20	47	2	55	59	+89	20	40	2	56	54	+89	20	38	2	57	55	+89	20	40
23	2	55	21	+89	20	46	2	56	01	+89	20	40	2	56	56	+89	20	38	2	57	57	+89	20	40
24	2	55	22	+89	20	46	2	56	02	+89	20	40	2	56	57	+89	20	38	2	57	59	+89	20	40
25	2	55	23	+89	20	46	2	56	04	+89	20	40	2	56	59	+89	20	38	2	58	01	+89	20	40
26	2	55	24	+89	20	45	2	56	05	+89	20	39	2	57	01	+89	20	38	2	58	04	+89	20	40
27	2	55	25	+89	20	45	2	56	07	+89	20	39	2	57	03	+89	20	38	2	58	06	+89	20	41
28	2	55	26	+89	20	45	2	56	08	+89	20	39	2	57	05	+89	20	38	2	58	08	+89	20	41
29	2	55	27	+89	20	45	2	56	10	+89	20	39	2	57	07	+89	20	38	2	58	10	+89	20	41
30	2	55	28	+89	20	45	2	56	11	+89	20	39	2	57	09	+89	20	38	2	58	12	+89	20	41
31	2	55	29	+89	20	44							2	57	12	+89	20	38	2	58	14	+89	20	41

APPARENT PLACES OF POLARIS, 2020

FOR 0^h TERRESTRIAL TIME

	α Ursae Minoris											Mag. 2.02									Sp. F8v			
	SEPTEMBER						OCTOBER						NOVEMBER						DECEMBER					
Date	Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
1	2	58	15	+89	20	42	2	59	05	+89	20	49	2	59	36	+89	20	60	2	59	38	+89	21	11
2	2	58	17	+89	20	42	2	59	06	+89	20	50	2	59	36	+89	21	00	2	59	38	+89	21	11
3	2	58	19	+89	20	42	2	59	07	+89	20	50	2	59	37	+89	21	01	2	59	38	+89	21	12
4	2	58	20	+89	20	42	2	59	09	+89	20	50	2	59	38	+89	21	01	2	59	37	+89	21	12
5	2	58	22	+89	20	42	2	59	10	+89	20	50	2	59	39	+89	21	01	2	59	37	+89	21	12
6	2	58	24	+89	20	43	2	59	11	+89	20	51	2	59	39	+89	21	02	2	59	36	+89	21	13
7	2	58	26	+89	20	43	2	59	13	+89	20	51	2	59	40	+89	21	02	2	59	35	+89	21	13
8	2	58	28	+89	20	43	2	59	14	+89	20	51	2	59	40	+89	21	03	2	59	34	+89	21	14
9	2	58	29	+89	20	43	2	59	16	+89	20	52	2	59	40	+89	21	03	2	59	33	+89	21	14
10	2	58	31	+89	20	43	2	59	17	+89	20	52	2	59	40	+89	21	03	2	59	33	+89	21	14
11	2	58	33	+89	20	44	2	59	18	+89	20	52	2	59	40	+89	21	04	2	59	32	+89	21	14
12	2	58	35	+89	20	44	2	59	19	+89	20	53	2	59	40	+89	21	04	2	59	31	+89	21	15
13	2	58	37	+89	20	44	2	59	20	+89	20	53	2	59	40	+89	21	04	2	59	31	+89	21	15
14	2	58	39	+89	20	44	2	59	21	+89	20	54	2	59	40	+89	21	05	2	59	30	+89	21	15
15	2	58	41	+89	20	45	2	59	22	+89	20	54	2	59	41	+89	21	05	2	59	29	+89	21	16
16	2	58	42	+89	20	45	2	59	23	+89	20	54	2	59	41	+89	21	05	2	59	29	+89	21	16
17	2	58	43	+89	20	45	2	59	24	+89	20	54	2	59	41	+89	21	06	2	59	28	+89	21	16
18	2	58	45	+89	20	46	2	59	25	+89	20	55	2	59	42	+89	21	06	2	59	27	+89	21	17
19	2	58	46	+89	20	46	2	59	26	+89	20	55	2	59	42	+89	21	07	2	59	26	+89	21	17
20	2	58	48	+89	20	46	2	59	27	+89	20	55	2	59	42	+89	21	07	2	59	24	+89	21	17
21	2	58	50	+89	20	46	2	59	29	+89	20	56	2	59	42	+89	21	07	2	59	23	+89	21	18
22	2	58	52	+89	20	46	2	59	30	+89	20	56	2	59	41	+89	21	08	2	59	22	+89	21	18
23	2	58	54	+89	20	47	2	59	31	+89	20	57	2	59	41	+89	21	08	2	59	20	+89	21	18
24	2	58	55	+89	20	47	2	59	31	+89	20	57	2	59	41	+89	21	09	2	59	19	+89	21	18
25	2	58	57	+89	20	47	2	59	32	+89	20	57	2	59	40	+89	21	09	2	59	18	+89	21	19
26	2	58	59	+89	20	48	2	59	33	+89	20	58	2	59	40	+89	21	09	2	59	17	+89	21	19
27	2	58	60	+89	20	48	2	59	33	+89	20	58	2	59	39	+89	21	10	2	59	16	+89	21	19
28	2	59	01	+89	20	48	2	59	34	+89	20	59	2	59	39	+89	21	10	2	59	15	+89	21	19
29	2	59	02	+89	20	49	2	59	34	+89	20	59	2	59	39	+89	21	10	2	59	13	+89	21	20
30	2	59	04	+89	20	49	2	59	35	+89	20	59	2	59	39	+89	21	11	2	59	12	+89	21	20
31							2	59	35	+89	20	60							2	59	11	+89	21	20
32																			2	59	10	+89	21	21

POLARIS TABLE, 2020

LST	0^h		1^h		2^h		3^h		4^h		5^h	
	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0
m	′	′	′	′	′	′	′	′	′	′	′	′
0	-27.8	+27.6	-34.0	+19.4	-37.8	+9.8	-39.1	-0.5	-37.6	-10.7	-33.5	-20.2
3	28.2	27.2	34.3	18.9	38.0	9.3	39.1	1.0	37.5	11.2	33.3	20.6
6	28.5	26.8	34.5	18.5	38.1	8.8	39.0	1.5	37.3	11.7	33.0	21.0
9	28.9	26.5	34.7	18.0	38.2	8.3	39.0	2.0	37.2	12.2	32.7	21.5
12	29.2	26.1	35.0	17.5	38.3	7.8	39.0	2.5	37.0	12.7	32.4	21.9
15	-29.6	+25.7	-35.2	+17.1	-38.4	+7.3	-39.0	-3.1	-36.8	-13.2	-32.2	-22.3
18	29.9	25.3	35.4	16.6	38.5	6.8	38.9	3.6	36.6	13.6	31.9	22.8
21	30.2	24.9	35.6	16.1	38.6	6.3	38.9	4.1	36.5	14.1	31.6	23.2
24	30.6	24.5	35.8	15.7	38.7	5.7	38.8	4.6	36.3	14.6	31.2	23.6
27	30.9	24.1	36.0	15.2	38.7	5.2	38.7	5.1	36.1	15.1	30.9	24.0
30	-31.2	+23.7	-36.2	+14.7	-38.8	+4.7	-38.7	-5.6	-35.9	-15.6	-30.6	-24.4
33	31.5	23.3	36.4	14.2	38.9	4.2	38.6	6.1	35.7	16.0	30.3	24.8
36	31.8	22.8	36.6	13.7	38.9	3.7	38.5	6.7	35.5	16.5	30.0	25.2
39	32.1	22.4	36.8	13.3	39.0	3.2	38.4	7.2	35.2	17.0	29.6	25.6
42	32.4	22.0	37.0	12.8	39.0	2.6	38.3	7.7	35.0	17.4	29.3	26.0
45	-32.7	+21.6	-37.1	+12.3	-39.0	+2.1	-38.2	-8.2	-34.8	-17.9	-29.0	-26.4
48	32.9	21.1	37.3	11.8	39.0	1.6	38.1	8.7	34.6	18.4	28.6	26.7
51	33.2	20.7	37.4	11.3	39.1	1.1	38.0	9.2	34.3	18.8	28.3	27.1
54	33.5	20.3	37.6	10.8	39.1	+0.6	37.9	9.7	34.1	19.3	27.9	27.5
57	33.7	19.8	37.7	10.3	39.1	0.1	37.7	10.2	33.8	19.7	27.5	27.9
60	-34.0	+19.4	-37.8	+9.8	-39.1	-0.5	-37.6	-10.7	-33.5	-20.2	-27.2	-28.2
Lat.	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1
°												
0	-.1	-.3	-.1	-.2	.0	-.1	.0	.0	.0	+.1	-.1	+.2
10	-.1	-.2	-.1	-.2	.0	-.1	.0	.0	.0	+.1	-.1	+.2
20	-.1	-.2	.0	-.2	.0	-.1	.0	.0	.0	+.1	.0	+.2
30	-.1	-.1	.0	-.1	.0	-.1	.0	.0	.0	+.1	.0	+.1
40	.0	-.1	.0	-.1	.0	.0	.0	.0	.0	.0	.0	+.1
45	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	.0	+.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
60	+.1	+.1	.0	+.1	.0	+.1	.0	.0	.0	-.1	.0	-.1
62	+.1	+.2	.0	+.1	.0	+.1	.0	.0	.0	-.1	.0	-.1
64	+.1	+.2	.0	+.2	.0	+.1	.0	.0	.0	-.1	+.0	-.2
66	+.1	+.2	+.1	+.2	.0	+.1	.0	.0	.0	-.1	+.1	-.2
Month	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2
Jan.	+.2	-.1	+.2	-.1	+.2	.0	+.2	.0	+.2	+.1	+.1	+.1
Feb.	+.1	-.2	+.1	-.2	+.2	-.2	+.2	-.1	+.2	-.1	+.3	.0
Mar.	-.1	-.3	.0	-.3	+.1	-.3	+.2	-.3	+.2	-.2	+.3	-.1
Apr.	-.2	-.3	-.1	-.3	-.1	-.3	.0	-.3	+.1	-.3	+.2	-.3
May	-.3	-.2	-.3	-.2	-.2	-.3	-.1	-.3	.0	-.4	+.1	-.4
June	-.3	.0	-.3	-.1	-.3	-.2	-.2	-.3	-.2	-.3	-.1	-.3
July	-.3	+.1	-.3	.1	-.3	.0	-.3	-.1	-.3	-.2	-.2	-.2
Aug.	-.1	+.2	-.2	+.2	-.2	+.1	-.3	+.1	-.3	.0	-.3	-.1
Sept.	.0	+.3	.0	+.3	-.1	+.3	-.2	+.2	-.2	+.2	-.3	+.1
Oct.	+.2	+.3	+.2	+.3	+.1	+.3	.0	+.3	-.1	+.3	-.2	+.3
Nov.	+.4	+.2	+.3	+.3	+.3	+.3	+.2	+.4	.1	+.4	-.1	+.4
Dec.	+.5	.0	+.5	+.1	+.4	+.3	+.3	+.4	+.2	+.4	+.1	+.5

Latitude = Corrected observed altitude of *Polaris* + a_0 + a_1 + a_2
Azimuth of *Polaris* = (b_0 + b_1 + b_2)/ cos (latitude)

POLARIS TABLE, 2020

LST	6^h		7^h		8^h		9^h		10^h		11^h	
	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0
m	′	′	′	′	′	′	′	′	′	′	′	′
0	-27.2	-28.2	-18.9	-34.3	-9.4	-38.0	+0.7	-39.1	+10.8	-37.5	+20.1	-33.4
3	26.8	28.6	18.5	34.5	8.9	38.1	1.2	39.1	11.3	37.3	20.6	33.1
6	26.4	28.9	18.0	34.8	8.4	38.2	1.7	39.0	11.8	37.2	21.0	32.8
9	26.0	29.3	17.6	35.0	7.9	38.3	2.3	39.0	12.3	37.0	21.4	32.6
12	25.7	29.6	17.1	35.2	7.4	38.4	2.8	39.0	12.7	36.9	21.8	32.3
15	-25.3	-29.9	-16.7	-35.5	-6.9	-38.5	+3.3	-38.9	+13.2	-36.7	+22.3	-32.0
18	24.9	30.3	16.2	35.7	6.4	38.6	3.8	38.9	13.7	36.5	22.7	31.7
21	24.5	30.6	15.7	35.9	5.9	38.7	4.3	38.8	14.2	36.3	23.1	31.4
24	24.1	30.9	15.3	36.1	5.4	38.7	4.8	38.8	14.7	36.1	23.5	31.1
27	23.7	31.2	14.8	36.3	4.9	38.8	5.3	38.7	15.1	35.9	23.9	30.8
30	-23.3	-31.5	-14.3	-36.5	-4.4	-38.9	+5.8	-38.6	+15.6	-35.7	+24.3	-30.5
33	22.8	31.8	13.8	36.6	3.9	38.9	6.3	38.5	16.1	35.5	24.7	30.1
36	22.4	32.1	13.3	36.8	3.4	39.0	6.8	38.4	16.5	35.3	25.1	29.8
39	22.0	32.4	12.9	37.0	2.9	39.0	7.3	38.3	17.0	35.1	25.5	29.5
42	21.6	32.7	12.4	37.1	2.3	39.0	7.8	38.2	17.4	34.9	25.9	29.2
45	-21.1	-33.0	-11.9	-37.3	-1.8	-39.0	+8.3	-38.1	+17.9	-34.6	+26.3	-28.8
48	20.7	33.3	11.4	37.5	1.3	39.1	8.8	38.0	18.4	34.4	26.6	28.5
51	20.3	33.5	10.9	37.6	-0.8	39.1	9.3	37.9	18.8	34.1	27.0	28.1
54	19.8	33.8	10.4	37.7	-+0.3	39.1	9.8	37.8	19.2	33.9	27.4	27.8
57	19.4	34.0	9.9	37.9	0.2	39.1	10.3	37.6	19.7	33.6	27.7	27.4
60	-18.9	-34.3	-9.4	-38.0	+0.7	-39.1	+10.8	-37.5	+20.1	-33.4	+28.1	-27.0
Lat.	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1
°												
0	-.1	+.3	-.2	+.2	-.2	+.1	-.3	.0	-.2	-.1	-.2	-.2
10	-.1	+.2	-.2	+.2	-.2	+.1	-.2	.0	-.2	-.1	-.2	-.2
20	-.1	+.2	-.1	+.2	-.2	+.1	-.2	.0	-.2	-.1	-.1	-.2
30	-.1	+.1	-.1	+.1	-.1	+.1	-.1	.0	-.1	-.1	-.1	-.1
40	.0	+.1	-.1	+.1	-.1	.0	-.1	.0	-.1	.0	-.1	-.1
45	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	.0	-.1	.0	.0	+.0	.0	+.1	.0	.0	.0	.0	.0
60	+.1	-.1	+.1	-.1	+.1	-.1	+.1	.0	+.1	+.1	+.1	+.1
62	+.1	-.2	+.1	-.1	+.1	-.1	+.2	.0	+.1	+.1	+.1	+.1
64	+.1	-.2	+.1	-.2	+.2	-.1	+.2	.0	+.2	+.1	+.1	+.2
66	+.1	-.2	+.2	-.2	+.2	-.1	+.2	.0	+.2	+.1	+.2	+.2
Month	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2
Jan.	+.1	+.2	+.1	+.2	.0	+.2	.0	+.2	-.1	+.2	-.1	+.1
Feb.	+.2	+.1	+.2	+.1	+.2	+.2	+.1	+.2	+.1	+.2	.0	+.3
Mar.	+.3	-.1	+.3	-.1	+.3	+.1	+.3	+.2	+.2	+.2	+.1	+.3
Apr.	+.3	-.2	+.3	-.2	+.3	-.1	+.4	.0	+.3	+.1	+.3	+.2
May	+.2	-.3	+.2	-.3	+.3	-.2	+.3	-.1	+.4	.0	+.4	+.1
June	.0	-.3	+.1	-.3	+.2	-.3	+.3	-.2	+.3	-.2	+.3	-.1
July	-.1	-.3	-.1	-.3	.0	-.3	+.1	-.3	+.2	-.3	+.2	-.2
Aug.	-.2	-.1	-.2	-.1	-.1	-.2	-.1	-.3	.0	-.3	+.1	-.3
Sept.	-.3	.0	-.3	.0	-.3	-.1	-.2	-.2	-.2	-.2	-.1	-.3
Oct.	-.3	+.2	-.3	+.2	-.3	+.1	-.3	.0	-.3	-.1	-.3	-.2
Nov.	-.2	+.4	-.3	+.4	-.3	+.3	-.4	+.2	-.4	.1	-.4	-.1
Dec.	.0	+.5	-.1	+.5	-.3	+.4	-.4	+.3	-.4	+.2	-.5	+.1

Latitude = Corrected observed altitude of *Polaris* + $a_0 + a_1 + a_2$

Azimuth of *Polaris* = $(b_0 + b_1 + b_2)/\cos$ (latitude)

POLARIS TABLE, 2020

LST	12^h		13^h		14^h		15^h		16^h		17^h	
	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0
m	′	′	′	′	′	′	′	′	′	′	′	′
0	+28.1	-27.0	+34.1	-18.9	+37.9	-9.5	+39.1	+0.5	+37.6	+10.4	+33.7	+19.7
3	28.4	26.7	34.4	18.5	38.0	9.1	39.1	1.0	37.5	10.9	33.4	20.1
6	28.8	26.3	34.6	18.0	38.1	8.6	39.0	1.5	37.4	11.4	33.2	20.6
9	29.1	25.9	34.8	17.6	38.2	8.1	39.0	2.0	37.2	11.9	32.9	21.0
12	29.5	25.5	35.1	17.1	38.3	7.6	39.0	2.5	37.0	12.3	32.6	21.4
15	+29.8	-25.2	+35.3	-16.7	+38.4	-7.1	+39.0	+3.0	+36.9	+12.8	+32.3	+21.8
18	30.1	24.8	35.5	16.2	38.5	6.6	38.9	3.5	36.7	13.3	32.0	22.3
21	30.4	24.4	35.7	15.7	38.6	6.1	38.9	4.0	36.5	13.8	31.7	22.7
24	30.8	24.0	35.9	15.3	38.7	5.6	38.8	4.5	36.4	14.2	31.4	23.1
27	31.1	23.6	36.1	14.8	38.7	5.1	38.8	5.0	36.2	14.7	31.1	23.5
30	+31.4	-23.2	+36.3	-14.3	+38.8	-4.6	+38.7	+5.5	+36.0	+15.2	+30.8	+23.9
33	31.7	22.8	36.5	13.9	38.9	4.1	38.6	6.0	35.8	15.6	30.5	24.3
36	32.0	22.3	36.7	13.4	38.9	3.6	38.5	6.5	35.6	16.1	30.2	24.7
39	32.3	21.9	36.8	12.9	39.0	3.1	38.4	7.0	35.3	16.6	29.9	25.1
42	32.5	21.5	37.0	12.5	39.0	2.6	38.3	7.5	35.1	17.0	29.5	25.5
45	+32.8	-21.1	+37.2	-12.0	+39.0	-2.1	+38.2	+8.0	+34.9	+17.5	+29.2	+25.8
48	33.1	20.7	37.3	11.5	39.0	1.6	38.1	8.5	34.7	17.9	28.9	26.2
51	33.4	20.2	37.5	11.0	39.1	1.1	38.0	8.9	34.4	18.4	28.5	26.6
54	33.6	19.8	37.6	10.5	39.1	-0.6	37.9	9.4	34.2	18.8	28.2	27.0
57	33.9	19.4	37.7	10.0	39.1	-+0.1	37.8	9.9	33.9	19.3	27.8	27.3
60	+34.1	-18.9	+37.9	-9.5	+39.1	+0.5	+37.6	+10.4	+33.7	+19.7	+27.4	+27.7
Lat.	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1
°												
0	-.1	-.3	-.1	-.2	.0	-.1	.0	.0	.0	+.1	-.1	+.2
10	-.1	-.2	-.1	-.2	.0	-.1	.0	.0	.0	+.1	-.1	+.2
20	-.1	-.2	.0	-.2	.0	-.1	.0	.0	.0	+.1	.0	+.2
30	-.1	-.1	.0	-.1	.0	-.1	.0	.0	.0	+.1	.0	+.1
40	.0	-.1	.0	-.1	.0	.0	.0	.0	.0	.0	.0	+.1
45	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	.0	+.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
60	+.1	+.1	.0	+.1	.0	+.1	.0	.0	.0	-.1	.0	-.1
62	+.1	+.2	.0	+.1	.0	+.1	.0	.0	.0	-.1	.0	-.1
64	+.1	+.2	.0	+.2	.0	+.1	.0	.0	.0	-.1	+.0	-.2
66	+.1	+.2	+.1	+.2	.0	+.1	.0	.0	.0	-.1	+.1	-.2
Month	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2
Jan.	-.2	+.1	-.2	+.1	-.2	.0	-.2	.0	-.2	-.1	-.1	-.1
Feb.	-.1	+.2	-.1	+.2	-.2	+.2	-.2	+.1	-.2	+.1	-.3	.0
Mar.	+.1	+.3	.0	+.3	-.1	+.3	-.2	+.3	-.2	+.2	-.3	+.1
Apr.	+.2	+.3	+.1	+.3	.1	+.3	.0	+.4	-.1	+.3	-.2	+.3
May	+.3	+.2	+.3	+.2	+.2	+.3	+.1	+.3	.0	+.4	-.1	+.4
June	+.3	.0	+.3	+.1	+.3	+.2	+.2	+.3	+.2	+.3	+.1	+.3
July	+.3	-.1	+.3	-.1	+.3	.0	+.3	+.1	+.3	+.2	+.2	+.2
Aug.	+.1	-.2	+.2	-.2	+.2	-.1	+.3	-.1	+.3	.0	+.3	+.1
Sept.	.0	-.3	.0	-.3	+.1	-.3	+.2	-.2	+.2	-.2	+.3	-.1
Oct.	-.2	-.3	-.2	-.3	-.1	-.3	.0	-.3	+.1	-.3	+.2	-.3
Nov.	-.4	-.2	-.3	-.3	-.3	-.3	-.2	-.4	-.1	-.4	+.1	-.4
Dec.	-.5	.0	-.5	-.1	-.4	-.3	-.3	-.4	-.2	-.4	-.1	-.5

Latitude = Corrected observed altitude of *Polaris* + a_0 + a_1 + a_2
Azimuth of *Polaris* = (b_0 + b_1 + b_2)/ cos (latitude)

POLARIS TABLE, 2020

LST	18^h		19^h		20^h		21^h		22^h		23^h	
	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0
m	′	′	′	′	′	′	′	′	′	′	′	′
0	+27.4	+27.7	+19.3	+33.8	+9.9	+37.7	-0.2	+39.1	-10.3	+37.8	-19.7	+33.8
3	27.1	28.0	18.9	34.1	9.4	37.9	0.7	39.1	10.8	37.6	20.2	33.6
6	26.7	28.4	18.5	34.3	8.9	38.0	1.2	39.1	11.3	37.5	20.6	33.3
9	26.3	28.7	18.0	34.6	8.4	38.1	1.7	39.1	11.8	37.3	21.1	33.0
12	26.0	29.1	17.5	34.8	7.9	38.2	2.2	39.0	12.3	37.2	21.5	32.8
15	+25.6	+29.4	+17.1	+35.0	+7.4	+38.3	-2.7	+39.0	-12.8	+37.0	-21.9	+32.5
18	25.2	29.7	16.6	35.3	6.9	38.4	3.3	39.0	13.2	36.9	22.3	32.2
21	24.8	30.1	16.2	35.5	6.4	38.5	3.8	38.9	13.7	36.7	22.8	31.9
24	24.4	30.4	15.7	35.7	5.9	38.6	4.3	38.9	14.2	36.5	23.2	31.6
27	24.0	30.7	15.2	35.9	5.4	38.7	4.8	38.8	14.7	36.3	23.6	31.3
30	+23.6	+31.0	+14.8	+36.1	+4.9	+38.7	-5.3	+38.8	-15.2	+36.1	-24.0	+31.0
33	23.2	31.3	14.3	36.3	4.4	38.8	5.8	38.7	15.6	35.9	24.4	30.7
36	22.8	31.6	13.8	36.5	3.9	38.9	6.3	38.6	16.1	35.7	24.8	30.3
39	22.4	31.9	13.3	36.7	3.4	38.9	6.8	38.5	16.6	35.5	25.2	30.0
42	21.9	32.2	12.9	36.8	2.9	39.0	7.3	38.4	17.0	35.3	25.6	29.7
45	+21.5	+32.5	+12.4	+37.0	+2.4	+39.0	-7.8	+38.3	-17.5	+35.1	-26.0	+29.3
48	21.1	32.8	11.9	37.2	1.9	39.0	8.3	38.2	17.9	34.8	26.3	29.0
51	20.7	33.1	11.4	37.3	1.3	39.0	8.8	38.1	18.4	34.6	26.7	28.6
54	20.2	33.3	10.9	37.5	0.8	39.1	9.3	38.0	18.8	34.3	27.1	28.3
57	19.8	33.6	10.4	37.6	+0.3	39.1	9.8	37.9	19.3	34.1	27.5	27.9
60	+19.3	+33.8	+9.9	+37.7	-0.2	+39.1	-10.3	+37.8	-19.7	+33.8	-27.8	+27.6
Lat. °	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1
0	-.1	+.3	-.2	+.2	-.2	+.1	-.3	.0	-.2	-.1	-.2	-.2
10	-.1	+.2	-.2	+.2	-.2	+.1	-.2	.0	-.2	-.1	-.2	-.2
20	-.1	+.2	-.1	+.2	-.2	+.1	-.2	.0	-.2	-.1	-.1	-.2
30	-.1	+.1	-.1	+.1	-.1	+.1	-.1	.0	-.1	-.1	-.1	-.1
40	.0	+.1	-.1	+.1	-.1	.0	-.1	.0	-.1	.0	-.1	-.1
45	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	.0	-.1	.0	.0	+.0	.0	+.1	.0	.0	.0	.0	.0
60	+.1	-.1	+.1	-.1	+.1	-.1	+.1	.0	+.1	+.1	+.1	+.1
62	+.1	-.2	+.1	-.1	+.1	-.1	+.2	.0	+.1	+.1	+.1	+.1
64	+.1	-.2	+.1	-.2	+.2	-.1	+.2	.0	+.2	+.1	+.1	+.2
66	+.1	-.2	+.2	-.2	+.2	-.1	+.2	.0	+.2	+.1	+.2	+.2
Month	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2
Jan.	-.1	-.2	-.1	-.2	.0	-.2	.0	-.2	+.1	-.2	+.1	-.1
Feb.	-.2	-.1	-.2	-.1	-.2	-.2	-.1	-.2	-.1	-.2	.0	-.3
Mar.	-.3	+.1	-.3	.0	-.3	-.1	-.3	-.2	-.2	-.2	-.1	-.3
Apr.	-.3	+.2	-.3	+.1	-.3	.1	-.4	.0	-.3	-.1	-.3	-.2
May	-.2	+.3	-.2	+.3	-.3	+.2	-.3	+.1	-.4	.0	-.4	-.1
June	.0	+.3	-.1	+.3	-.2	+.3	-.3	+.2	-.3	+.2	-.3	+.1
July	+.1	+.3	.1	+.3	.0	+.3	-.1	+.3	-.2	+.3	-.2	+.2
Aug.	+.2	+.1	+.2	+.2	+.1	+.2	+.1	+.3	.0	+.3	-.1	+.3
Sept.	+.3	.0	+.3	.0	+.3	+.1	+.2	+.2	+.2	+.2	+.1	+.3
Oct.	+.3	-.2	+.3	-.2	+.3	-.1	+.3	.0	+.3	+.1	+.3	+.2
Nov.	+.2	-.4	+.3	-.3	+.3	-.3	+.4	-.2	+.4	-.1	+.4	+.1
Dec.	.0	-.5	+.1	-.5	+.3	-.4	+.4	-.3	+.4	-.2	+.5	-.1

Latitude = Corrected observed altitude of *Polaris* + a_0 + a_1 + a_2

Azimuth of *Polaris* = (b_0 + b_1 + b_2)/ cos (latitude)

PART - III

SUNRISE, SUNSET AND MOONRISE, MOONSET

SUNRISE, 2020

LOCAL MEAN TIME OF SUNRISE (SUN'S UPPER LIMB) AND BEGINNING OF MORNING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian.

In India, to obtain I.S.T., add 4 x (82º.5 - λ) mins. or deduct 4 x (λ - 82º.5) mins. as the station is west or east of 82º.5 E. Longitude.

Date \ Lat.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 1	6 00	6 17	6 35	6 56	7 08	7 22	7 38	7 59	8 08	8 19	8 31	8 46	9 02
5	6 01	6 18	6 36	6 57	7 08	7 22	7 38	7 58	8 07	8 18	8 30	8 44	9 00
9	6 03	6 20	6 37	6 57	7 09	7 22	7 37	7 57	8 06	8 16	8 27	8 41	8 56
13	6 05	6 21	6 38	6 57	7 08	7 21	7 36	7 54	8 03	8 13	8 24	8 37	8 51
17	6 06	6 22	6 38	6 56	7 07	7 19	7 34	7 51	8 00	8 09	8 19	8 31	8 45
21	6 08	6 22	6 38	6 55	7 06	7 17	7 31	7 48	7 56	8 04	8 14	8 25	8 38
25	6 09	6 23	6 37	6 54	7 04	7 15	7 28	7 43	7 51	7 59	8 08	8 18	8 30
29	6 09	6 23	6 36	6 52	7 01	7 12	7 24	7 38	7 45	7 53	8 01	8 11	8 22
Feb. 2	6 10	6 22	6 35	6 50	6 59	7 08	7 19	7 33	7 39	7 46	7 54	8 03	8 13
6	6 11	6 22	6 34	6 47	6 55	7 04	7 14	7 27	7 33	7 39	7 46	7 54	8 03
10	6 11	6 21	6 32	6 45	6 52	7 00	7 09	7 20	7 26	7 31	7 38	7 45	7 53
14	6 11	6 20	6 30	6 41	6 48	6 55	7 03	7 13	7 18	7 23	7 29	7 35	7 42
18	6 11	6 19	6 28	6 38	6 43	6 50	6 57	7 06	7 10	7 15	7 20	7 25	7 31
22	6 10	6 18	6 25	6 34	6 39	6 44	6 51	6 59	7 02	7 06	7 10	7 15	7 20
26	6 10	6 16	6 22	6 30	6 34	6 39	6 44	6 51	6 54	6 57	7 00	7 04	7 09
Mar. 1	6 09	6 14	6 20	6 26	6 29	6 33	6 37	6 43	6 45	6 48	6 51	6 54	6 57
5	6 08	6 12	6 16	6 21	6 24	6 27	6 30	6 34	6 36	6 38	6 40	6 43	6 46
9	6 07	6 10	6 13	6 17	6 18	6 21	6 23	6 26	6 27	6 28	6 30	6 32	6 34
13	6 06	6 08	6 10	6 12	6 13	6 14	6 16	6 17	6 18	6 19	6 20	6 21	6 22
17	6 05	6 06	6 06	6 07	6 07	6 08	6 08	6 09	6 09	6 09	6 09	6 09	6 10
21	6 04	6 03	6 03	6 02	6 02	6 01	6 01	6 00	6 00	5 59	5 59	5 58	5 57
25	6 03	6 01	5 59	5 57	5 56	5 55	5 53	5 51	5 50	5 49	5 48	5 47	5 45
29	6 01	5 59	5 56	5 53	5 51	5 48	5 46	5 42	5 41	5 39	5 38	5 36	5 33
Apr. 2	6 00	5 57	5 53	5 48	5 45	5 42	5 38	5 34	5 32	5 30	5 27	5 24	5 21

BEGINNING OF MORNING TWILIGHT

Date	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 1	4 45	5 01	5 16	5 31	5 37	5 45	5 52	6 00	6 03	6 06	6 10	6 14	6 18
9	4 49	5 05	5 19	5 32	5 39	5 45	5 52	5 59	6 02	6 05	6 08	6 12	6 16
17	4 53	5 07	5 21	5 33	5 38	5 44	5 50	5 56	5 58	6 01	6 04	6 06	6 09
25	4 56	5 09	5 21	5 31	5 36	5 41	5 45	5 50	5 52	5 54	5 56	5 58	6 00
Feb. 2	4 58	5 10	5 20	5 28	5 32	5 35	5 39	5 42	5 43	5 44	5 45	5 46	5 47
10	5 00	5 10	5 17	5 24	5 26	5 28	5 30	5 31	5 31	5 31	5 31	5 31	5 30
18	5 00	5 08	5 14	5 18	5 19	5 19	5 19	5 18	5 17	5 16	5 15	5 13	5 12
26	5 00	5 06	5 09	5 10	5 10	5 09	5 07	5 03	5 01	4 59	4 57	4 54	4 50
Mar. 5	4 59	5 02	5 03	5 02	5 00	4 57	4 53	4 47	4 44	4 40	4 36	4 32	4 26
13	4 57	4 58	4 57	4 52	4 49	4 44	4 38	4 29	4 25	4 20	4 14	4 08	4 00
21	4 55	4 54	4 50	4 43	4 37	4 30	4 22	4 10	4 04	3 58	3 50	3 41	3 31
29	4 53	4 49	4 42	4 32	4 25	4 16	4 05	3 50	3 42	3 34	3 24	3 12	2 59
Apr. 6	4 50	4 44	4 35	4 21	4 13	4 02	3 47	3 29	3 19	3 08	2 56	2 40	2 21

SUNSET, 2020

LOCAL MEAN TIME OF SUNSET (SUN'S UPPER LIMB) AND ENDING
OF EVENING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian.

In India, to obtain I.S.T., add 4 x (82º.5 - λ) mins. or deduct 4 x (λ - 82º.5) mins. as the station is west or east of 82º.5 E. Longitude**.**

Date \ Lat.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 1	18 07	17 50	17 32	17 11	16 59	16 45	16 29	16 08	15 59	15 48	15 36	15 21	15 04
5	18 09	17 52	17 34	17 14	17 02	16 48	16 32	16 13	16 03	15 53	15 41	15 27	15 11
9	18 11	17 54	17 37	17 17	17 05	16 52	16 37	16 17	16 08	15 58	15 47	15 34	15 18
13	18 12	17 56	17 40	17 20	17 09	16 56	16 41	16 23	16 14	16 04	15 54	15 41	15 26
17	18 14	17 58	17 42	17 24	17 13	17 01	16 46	16 29	16 20	16 11	16 01	15 49	15 35
21	18 15	18 00	17 45	17 27	17 17	17 05	16 52	16 35	16 27	16 18	16 09	15 58	15 45
25	18 16	18 02	17 47	17 31	17 21	17 10	16 57	16 41	16 34	16 26	16 17	16 07	15 55
29	18 17	18 04	17 50	17 34	17 25	17 15	17 03	16 48	16 41	16 34	16 25	16 16	16 05
Feb. 2	18 17	18 05	17 52	17 38	17 29	17 20	17 08	16 55	16 49	16 42	16 34	16 25	16 15
6	18 18	18 06	17 54	17 41	17 33	17 24	17 14	17 02	16 56	16 50	16 43	16 35	16 26
10	18 18	18 07	17 57	17 44	17 37	17 29	17 20	17 09	17 04	16 58	16 52	16 45	16 36
14	18 18	18 08	17 59	17 47	17 41	17 34	17 26	17 16	17 11	17 06	17 00	16 54	16 47
18	18 17	18 09	18 00	17 51	17 45	17 39	17 31	17 23	17 18	17 14	17 09	17 04	16 58
22	18 17	18 10	18 02	17 54	17 49	17 43	17 37	17 29	17 26	17 22	17 18	17 13	17 08
26	18 16	18 10	18 04	17 57	17 52	17 48	17 42	17 36	17 33	17 30	17 26	17 23	17 18
Mar. 1	18 16	18 11	18 05	17 59	17 56	17 52	17 48	17 43	17 40	17 38	17 35	17 32	17 28
5	18 15	18 11	18 07	18 02	17 59	17 57	17 53	17 49	17 48	17 46	17 44	17 41	17 39
9	18 14	18 11	18 08	18 05	18 03	18 01	17 59	17 56	17 55	17 53	17 52	17 50	17 49
13	18 13	18 11	18 09	18 07	18 06	18 05	18 04	18 02	18 02	18 01	18 00	17 59	17 58
17	18 11	18 11	18 10	18 10	18 10	18 09	18 09	18 09	18 09	18 09	18 08	18 08	18 08
21	18 10	18 11	18 11	18 12	18 13	18 13	18 14	18 15	18 16	18 16	18 17	18 17	18 18
25	18 09	18 11	18 13	18 15	18 16	18 18	18 19	18 21	18 23	18 24	18 25	18 26	18 28
29	18 08	18 11	18 14	18 17	18 19	18 22	18 24	18 28	18 29	18 31	18 33	18 35	18 38
Apr. 2	18 07	18 11	18 15	18 20	18 22	18 26	18 29	18 34	18 36	18 39	18 41	18 44	18 47

END OF EVENING TWILIGHT

Date	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 1	19 22	19 05	18 50	18 36	18 29	18 22	18 15	18 07	18 04	18 00	17 57	17 53	17 49
9	19 25	19 09	18 55	18 42	18 35	18 29	18 22	18 15	18 12	18 09	18 06	18 02	17 59
17	19 27	19 12	18 59	18 48	18 42	18 36	18 30	18 24	18 22	18 19	18 17	18 14	18 11
25	19 29	19 15	19 04	18 54	18 49	18 44	18 40	18 35	18 33	18 31	18 29	18 28	18 26
Feb. 2	19 29	19 17	19 08	18 59	18 56	18 52	18 49	18 46	18 45	18 44	18 43	18 43	18 42
10	19 29	19 19	19 11	19 05	19 03	19 01	18 59	18 58	18 58	18 58	18 58	18 59	18 59
18	19 27	19 20	19 14	19 11	19 10	19 09	19 10	19 11	19 12	19 13	19 14	19 16	19 18
26	19 26	19 20	19 17	19 16	19 17	19 18	19 20	19 24	19 26	19 28	19 31	19 34	19 37
Mar. 5	19 24	19 21	19 20	19 21	19 24	19 27	19 31	19 37	19 40	19 44	19 48	19 53	19 58
13	19 21	19 21	19 22	19 27	19 30	19 35	19 42	19 51	19 55	20 00	20 06	20 13	20 21
21	19 19	19 21	19 25	19 32	19 38	19 45	19 54	20 05	20 11	20 18	20 26	20 35	20 46
29	19 17	19 21	19 27	19 38	19 45	19 54	20 06	20 21	20 29	20 37	20 48	20 59	21 14
Apr. 6	19 15	19 21	19 30	19 44	19 53	20 04	20 19	20 38	20 47	20 58	21 12	21 27	21 47

SUNRISE, 2020

LOCAL MEAN TIME OF SUNRISE (SUN'S UPPER LIMB) AND BEGINNING
OF MORNING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian.

In India, to obtain I.S.T., add 4 x (82º.5 - λ) mins. or deduct 4 x (λ - 82º.5) mins. as the station is west or east of 82º.5 E. Longitude.

Date \ Lat.		0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	2	6 00	5 57	5 53	5 48	5 45	5 42	5 38	5 34	5 32	5 30	5 27	5 24	5 21
	6	5 59	5 54	5 49	5 43	5 40	5 36	5 31	5 25	5 23	5 20	5 17	5 13	5 09
	10	5 58	5 52	5 46	5 38	5 34	5 29	5 24	5 17	5 14	5 10	5 06	5 02	4 57
	14	5 57	5 50	5 43	5 34	5 29	5 23	5 17	5 08	5 05	5 01	4 56	4 51	4 45
	18	5 56	5 48	5 39	5 30	5 24	5 17	5 10	5 00	4 56	4 51	4 46	4 40	4 34
	22	5 55	5 46	5 37	5 25	5 19	5 12	5 03	4 53	4 48	4 42	4 36	4 30	4 22
	26	5 54	5 44	5 34	5 22	5 14	5 06	4 57	4 45	4 39	4 33	4 27	4 19	4 11
	30	5 54	5 43	5 31	5 18	5 10	5 01	4 50	4 38	4 32	4 25	4 18	4 09	4 00
May	4	5 53	5 42	5 29	5 14	5 06	4 56	4 45	4 31	4 24	4 17	4 09	3 59	3 49
	8	5 53	5 40	5 27	5 11	5 02	4 52	4 39	4 24	4 17	4 09	4 00	3 50	3 39
	12	5 53	5 39	5 25	5 08	4 59	4 47	4 34	4 18	4 10	4 02	3 52	3 41	3 29
	16	5 53	5 39	5 23	5 06	4 56	4 44	4 30	4 12	4 04	3 55	3 45	3 33	3 19
	20	5 53	5 38	5 22	5 04	4 53	4 40	4 25	4 07	3 59	3 49	3 38	3 25	3 10
	24	5 53	5 38	5 21	5 02	4 51	4 37	4 22	4 03	3 54	3 43	3 32	3 18	3 02
	28	5 54	5 38	5 20	5 00	4 49	4 35	4 19	3 59	3 49	3 39	3 26	3 12	2 55
Jun.	1	5 54	5 38	5 20	4 59	4 47	4 33	4 16	3 56	3 46	3 35	3 22	3 07	2 49
	5	5 55	5 38	5 20	4 59	4 46	4 32	4 15	3 53	3 43	3 31	3 18	3 02	2 44
	9	5 56	5 39	5 20	4 58	4 46	4 31	4 13	3 51	3 41	3 29	3 15	2 59	2 40
	13	5 57	5 39	5 20	4 58	4 46	4 31	4 13	3 50	3 40	3 28	3 14	2 57	2 37
	17	5 57	5 40	5 21	4 59	4 46	4 31	4 13	3 50	3 39	3 27	3 13	2 56	2 36
	21	5 58	5 41	5 22	5 00	4 47	4 31	4 13	3 51	3 40	3 28	3 13	2 56	2 36
	25	5 59	5 42	5 23	5 01	4 48	4 33	4 15	3 52	3 41	3 29	3 15	2 58	2 38
	29	6 00	5 43	5 24	5 02	4 49	4 34	4 16	3 54	3 43	3 31	3 17	3 01	2 41
July	3	6 01	5 44	5 25	5 04	4 51	4 36	4 19	3 57	3 46	3 34	3 21	3 05	2 45

BEGINNING OF MORNING TWILIGHT

Date		0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	6	4 50	4 44	4 35	4 21	4 13	4 02	3 47	3 29	3 19	3 08	2 56	2 40	2 21
	14	4 47	4 39	4 27	4 11	4 00	3 47	3 30	3 06	2 55	2 41	2 24	2 03	1 34
	22	4 45	4 34	4 20	4 01	3 48	3 32	3 12	2 43	2 29	2 11	1 48	1 14	
	30	4 43	4 30	4 14	3 51	3 36	3 18	2 54	2 19	2 00	1 36	0 58		
May	8	4 41	4 26	4 08	3 42	3 26	3 05	2 36	1 54	1 28	0 48			
	16	4 40	4 24	4 03	3 35	3 16	2 53	2 20	1 27	0 47				
	24	4 40	4 22	3 59	3 29	3 09	2 42	2 05	0 56					
June	1	4 40	4 21	3 57	3 25	3 03	2 34	1 52						
	9	4 41	4 21	3 56	3 22	3 00	2 29	1 44						
	17	4 42	4 22	3 57	3 22	2 59	2 28	1 40						
	25	4 44	4 24	3 59	3 24	3 01	2 29	1 42						
July	3	4 46	4 26	4 01	3 28	3 05	2 34	1 49						
	11	4 48	4 29	4 05	3 33	3 11	2 42	2 01						

SUNSET, 2020

LOCAL MEAN TIME OF SUNSET (SUN'S UPPER LIMB) AND ENDING
OF EVENING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian.

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Date \ Lat.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 2	18 07	18 11	18 15	18 20	18 22	18 26	18 29	18 34	18 36	18 39	18 41	18 44	18 47
6	18 06	18 10	18 16	18 22	18 26	18 30	18 35	18 40	18 43	18 46	18 49	18 53	18 57
10	18 04	18 10	18 17	18 24	18 29	18 34	18 40	18 47	18 50	18 53	18 57	19 02	19 07
14	18 03	18 10	18 18	18 27	18 32	18 38	18 45	18 53	18 57	19 01	19 06	19 11	19 17
18	18 03	18 11	18 19	18 29	18 35	18 42	18 50	18 59	19 04	19 08	19 14	19 20	19 27
22	18 02	18 11	18 21	18 32	18 38	18 46	18 55	19 05	19 10	19 16	19 22	19 29	19 37
26	18 01	18 11	18 22	18 34	18 42	18 50	19 00	19 12	19 17	19 23	19 30	19 38	19 47
30	18 01	18 12	18 23	18 37	18 45	18 54	19 05	19 18	19 24	19 31	19 38	19 47	19 56
May 4	18 00	18 12	18 25	18 40	18 48	18 58	19 10	19 24	19 31	19 38	19 46	19 56	20 06
8	18 00	18 13	18 26	18 42	18 51	19 02	19 15	19 30	19 37	19 45	19 54	20 04	20 16
12	18 00	18 13	18 28	18 45	18 55	19 06	19 19	19 36	19 43	19 52	20 02	20 13	20 26
16	18 00	18 14	18 30	18 47	18 58	19 10	19 24	19 41	19 50	19 59	20 09	20 21	20 35
20	18 00	18 15	18 31	18 50	19 01	19 13	19 28	19 47	19 56	20 05	20 16	20 29	20 44
24	18 00	18 16	18 33	18 52	19 04	19 17	19 32	19 52	20 01	20 11	20 23	20 37	20 53
28	18 01	18 17	18 34	18 55	19 06	19 20	19 36	19 57	20 06	20 17	20 29	20 44	21 01
June 1	18 02	18 18	18 36	18 57	19 09	19 23	19 40	20 01	20 11	20 22	20 35	20 50	21 08
5	18 02	18 19	18 37	18 59	19 11	19 26	19 43	20 04	20 15	20 27	20 40	20 56	21 15
9	18 03	18 20	18 39	19 00	19 13	19 28	19 46	20 08	20 18	20 30	20 44	21 00	21 20
13	18 04	18 21	18 40	19 02	19 15	19 30	19 48	20 10	20 21	20 33	20 47	21 04	21 24
17	18 05	18 22	18 41	19 03	19 16	19 31	19 49	20 12	20 23	20 35	20 49	21 06	21 27
21	18 06	18 23	18 42	19 04	19 17	19 32	19 50	20 13	20 24	20 36	20 50	21 07	21 28
25	18 06	18 24	18 43	19 05	19 18	19 33	19 51	20 13	20 24	20 36	20 51	21 07	21 28
29	18 07	18 25	18 43	19 05	19 18	19 33	19 51	20 13	20 24	20 36	20 50	21 06	21 26
July 3	18 08	18 25	18 44	19 05	19 18	19 32	19 50	20 12	20 22	20 34	20 48	21 04	21 23

END OF EVENING TWILIGHT

Date	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 6	19 15	19 21	19 30	19 44	19 53	20 04	20 19	20 38	20 47	20 58	21 12	21 27	21 47
14	19 13	19 22	19 34	19 50	20 01	20 15	20 32	20 56	21 08	21 22	21 39	22 01	22 32
22	19 12	19 23	19 37	19 57	20 10	20 26	20 47	21 16	21 31	21 49	22 14	22 49	
30	19 12	19 25	19 41	20 04	20 19	20 38	21 02	21 38	21 57	22 23	23 04		
May 8	19 12	19 27	19 46	20 11	20 28	20 50	21 18	22 02	22 28	23 14			
16	19 13	19 29	19 50	20 18	20 37	21 01	21 35	22 29	23 13				
24	19 14	19 32	19 55	20 25	20 46	21 13	21 50	23 03					
June 1	19 16	19 35	19 59	20 32	20 54	21 22	22 05						
9	19 18	19 38	20 03	20 37	21 00	21 30	22 16						
17	19 20	19 40	20 05	20 40	21 03	21 35	22 23						
25	19 22	19 42	20 07	20 41	21 05	21 36	22 24						
July 3	19 23	19 42	20 07	20 41	21 04	21 34	22 19						
11	19 23	19 42	20 06	20 38	21 00	21 28	22 09	23 51					

SUNRISE, 2020

LOCAL MEAN TIME OF SUNRISE (SUN'S UPPER LIMB) AND BEGINNING
OF MORNING TWILIGHT ON THE MERIDIAN OF GREENWICH

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Date \ Lat.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 3	6 01	5 44	5 25	5 04	4 51	4 36	4 19	3 57	3 46	3 34	3 21	3 05	2 45
7	6 01	5 45	5 26	5 05	4 53	4 38	4 21	4 00	3 50	3 38	3 25	3 09	2 51
11	6 02	5 46	5 28	5 07	4 55	4 41	4 24	4 04	3 54	3 43	3 30	3 15	2 57
15	6 02	5 47	5 29	5 09	4 58	4 44	4 28	4 08	3 58	3 48	3 36	3 21	3 04
19	6 03	5 47	5 31	5 12	5 00	4 47	4 32	4 13	4 04	3 53	3 42	3 28	3 13
23	6 03	5 48	5 32	5 14	5 03	4 51	4 36	4 18	4 09	3 59	3 48	3 36	3 21
27	6 03	5 49	5 34	5 16	5 06	4 54	4 40	4 23	4 15	4 06	3 56	3 44	3 30
31	6 03	5 50	5 35	5 19	5 09	4 58	4 45	4 28	4 21	4 12	4 03	3 52	3 39
Aug. 4	6 03	5 50	5 37	5 21	5 12	5 02	4 49	4 34	4 27	4 19	4 10	4 00	3 49
8	6 02	5 51	5 38	5 23	5 15	5 05	4 54	4 40	4 33	4 26	4 18	4 09	3 58
12	6 02	5 51	5 39	5 26	5 18	5 09	4 59	4 46	4 40	4 33	4 26	4 17	4 08
16	6 01	5 51	5 40	5 28	5 21	5 13	5 03	4 52	4 46	4 40	4 34	4 26	4 18
20	6 00	5 51	5 42	5 31	5 24	5 17	5 08	4 58	4 53	4 47	4 42	4 35	4 27
24	5 59	5 51	5 43	5 33	5 27	5 21	5 13	5 04	4 59	4 55	4 49	4 44	4 37
28	5 58	5 51	5 44	5 35	5 30	5 24	5 18	5 10	5 06	5 02	4 57	4 52	4 46
Sept. 1	5 57	5 51	5 45	5 37	5 33	5 28	5 22	5 16	5 12	5 09	5 05	5 01	4 56
5	5 55	5 51	5 45	5 39	5 36	5 32	5 27	5 21	5 19	5 16	5 13	5 09	5 05
9	5 54	5 50	5 46	5 42	5 39	5 36	5 32	5 27	5 25	5 23	5 21	5 18	5 15
13	5 53	5 50	5 47	5 44	5 42	5 39	5 37	5 33	5 32	5 30	5 28	5 26	5 24
17	5 51	5 50	5 48	5 46	5 45	5 43	5 41	5 39	5 38	5 37	5 36	5 35	5 33
21	5 50	5 49	5 49	5 48	5 48	5 47	5 46	5 45	5 45	5 45	5 44	5 43	5 43
25	5 48	5 49	5 50	5 50	5 50	5 51	5 51	5 51	5 52	5 52	5 52	5 52	5 52
29	5 47	5 49	5 50	5 52	5 53	5 55	5 56	5 57	5 58	5 59	6 00	6 01	6 02
Oct. 3	5 46	5 49	5 51	5 55	5 57	5 59	6 01	6 04	6 05	6 06	6 08	6 09	6 11

BEGINNING OF MORNING TWILIGHT

Date	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 3	4 46	4 26	4 01	3 28	3 05	2 34	1 49						
11	4 48	4 29	4 05	3 33	3 11	2 42	2 01						
19	4 49	4 31	4 09	3 39	3 18	2 52	2 15	1 06					
27	4 50	4 34	4 13	3 45	3 27	3 03	2 30	1 38	0 57				
Aug. 4	4 51	4 36	4 18	3 52	3 36	3 14	2 46	2 04	1 38	0 57			
12	4 50	4 38	4 21	3 59	3 44	3 26	3 02	2 27	2 08	1 43	1 05		
20	4 50	4 39	4 25	4 06	3 53	3 37	3 16	2 48	2 33	2 15	1 52	1 18	
28	4 48	4 40	4 28	4 12	4 01	3 48	3 30	3 07	2 55	2 41	2 25	2 03	1 34
Sept. 5	4 46	4 40	4 31	4 18	4 09	3 58	3 43	3 24	3 15	3 04	2 51	2 36	2 16
13	4 44	4 40	4 33	4 23	4 16	4 07	3 56	3 40	3 33	3 24	3 14	3 02	2 48
21	4 41	4 39	4 35	4 28	4 23	4 16	4 07	3 55	3 49	3 43	3 35	3 26	3 15
29	4 38	4 39	4 37	4 33	4 29	4 24	4 18	4 09	4 05	4 00	3 54	3 47	3 39
Oct. 7	4 35	4 38	4 39	4 38	4 36	4 33	4 28	4 22	4 19	4 15	4 11	4 07	4 01

SUNSET, 2020

LOCAL MEAN TIME OF SUNSET (SUN'S UPPER LIMB) AND ENDING
OF EVENING TWILIGHT ON THE MERIDIAN OF GREENWICH

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Date \ Lat.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 3	18 08	18 25	18 44	19 05	19 18	19 32	19 50	20 12	20 22	20 34	20 48	21 04	21 23
7	18 09	18 25	18 44	19 05	19 17	19 31	19 48	20 10	20 20	20 31	20 44	21 00	21 18
11	18 09	18 26	18 43	19 04	19 16	19 30	19 46	20 07	20 17	20 28	20 40	20 55	21 13
15	18 10	18 25	18 43	19 02	19 14	19 28	19 44	20 03	20 13	20 23	20 36	20 50	21 06
19	18 10	18 25	18 42	19 01	19 12	19 25	19 40	19 59	20 08	20 18	20 30	20 43	20 59
23	18 10	18 25	18 41	18 59	19 10	19 22	19 37	19 55	20 03	20 13	20 23	20 36	20 50
27	18 10	18 24	18 39	18 56	19 07	19 18	19 32	19 49	19 57	20 06	20 16	20 28	20 41
31	18 10	18 23	18 37	18 54	19 03	19 14	19 27	19 43	19 51	19 59	20 09	20 19	20 32
Aug. 4	18 09	18 22	18 35	18 51	19 00	19 10	19 22	19 37	19 44	19 52	20 00	20 10	20 22
8	18 09	18 21	18 33	18 47	18 56	19 05	19 17	19 30	19 37	19 44	19 52	20 01	20 11
12	18 08	18 19	18 30	18 44	18 51	19 00	19 11	19 23	19 29	19 36	19 43	19 51	20 00
16	18 08	18 17	18 28	18 40	18 47	18 55	19 04	19 16	19 21	19 27	19 33	19 41	19 49
20	18 07	18 15	18 25	18 36	18 42	18 49	18 58	19 08	19 13	19 18	19 24	19 30	19 38
24	18 06	18 13	18 22	18 31	18 37	18 43	18 51	19 00	19 04	19 09	19 14	19 20	19 26
28	18 04	18 11	18 18	18 27	18 32	18 37	18 44	18 52	18 55	18 59	19 04	19 09	19 14
Sept. 1	18 03	18 09	18 15	18 22	18 26	18 31	18 36	18 43	18 46	18 50	18 53	18 58	19 02
5	18 02	18 06	18 11	18 17	18 21	18 25	18 29	18 35	18 37	18 40	18 43	18 46	18 50
9	18 00	18 04	18 08	18 12	18 15	18 18	18 22	18 26	18 28	18 30	18 32	18 35	18 38
13	17 59	18 01	18 04	18 07	18 09	18 11	18 14	18 17	18 19	18 20	18 22	18 24	18 26
17	17 58	17 59	18 00	18 02	18 04	18 05	18 06	18 08	18 09	18 10	18 11	18 12	18 14
21	17 56	17 56	17 57	17 57	17 58	17 58	17 59	17 59	18 00	18 00	18 01	18 01	18 02
25	17 55	17 54	17 53	17 52	17 52	17 52	17 51	17 51	17 51	17 50	17 50	17 50	17 50
29	17 53	17 51	17 50	17 47	17 46	17 45	17 44	17 42	17 41	17 40	17 39	17 38	17 37
Oct. 3	17 52	17 49	17 46	17 43	17 41	17 39	17 36	17 33	17 32	17 31	17 29	17 27	17 25

END OF EVENING TWILIGHT

Date \ Lat.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 3	19 23	19 42	20 07	20 41	21 04	21 34	22 19						
11	19 23	19 42	20 06	20 38	21 00	21 28	22 09	23 51					
19	19 23	19 41	20 03	20 33	20 54	21 20	21 56	23 03					
27	19 23	19 39	19 59	20 27	20 46	21 09	21 41	22 33	23 10				
Aug. 4	19 21	19 36	19 54	20 19	20 36	20 57	21 24	22 06	22 30	23 08			
12	19 19	19 32	19 48	20 10	20 25	20 43	21 07	21 40	21 59	22 23	22 58		
20	19 17	19 27	19 41	20 00	20 13	20 28	20 49	21 16	21 31	21 48	22 10	22 42	
28	19 14	19 22	19 34	19 50	20 00	20 13	20 30	20 53	21 05	21 18	21 35	21 55	22 23
Sept. 5	19 11	19 17	19 26	19 39	19 48	19 58	20 12	20 31	20 40	20 51	21 03	21 18	21 37
13	19 08	19 11	19 18	19 28	19 35	19 44	19 55	20 10	20 17	20 25	20 35	20 46	21 00
21	19 05	19 06	19 10	19 17	19 22	19 29	19 38	19 49	19 55	20 01	20 09	20 18	20 28
29	19 02	19 01	19 03	19 07	19 10	19 15	19 21	19 30	19 34	19 39	19 45	19 51	19 59
Oct. 7	19 00	18 57	18 56	18 57	18 59	19 02	19 06	19 12	19 15	19 18	19 22	19 27	19 33

SUNRISE, 2020

LOCAL MEAN TIME OF SUNRISE (SUN'S UPPER LIMB) AND BEGINNING
OF MORNING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian.

In India, to obtain I.S.T., add 4 x (82º.5 - λ) mins. or deduct 4 x (λ - 82º.5) mins. as the station is west or east of 82º.5 E. Longitude.

Date \ Lat.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 3	5 46	5 49	5 51	5 55	5 57	5 59	6 01	6 04	6 05	6 06	6 08	6 09	6 11
7	5 44	5 48	5 53	5 57	6 00	6 03	6 06	6 10	6 12	6 14	6 16	6 18	6 21
11	5 43	5 48	5 54	6 00	6 03	6 07	6 11	6 16	6 18	6 21	6 24	6 27	6 30
15	5 42	5 48	5 55	6 02	6 06	6 11	6 16	6 22	6 25	6 29	6 32	6 36	6 40
19	5 42	5 49	5 56	6 05	6 10	6 15	6 21	6 29	6 32	6 36	6 40	6 45	6 50
23	5 41	5 49	5 58	6 08	6 13	6 19	6 27	6 35	6 39	6 44	6 49	6 54	7 00
27	5 40	5 50	5 59	6 10	6 17	6 24	6 32	6 42	6 47	6 52	6 57	7 03	7 10
31	5 40	5 50	6 01	6 13	6 20	6 28	6 38	6 49	6 54	6 59	7 06	7 13	7 21
Nov. 4	5 40	5 51	6 03	6 16	6 24	6 33	6 43	6 55	7 01	7 07	7 14	7 22	7 31
8	5 40	5 52	6 05	6 20	6 28	6 37	6 49	7 02	7 08	7 15	7 23	7 31	7 41
12	5 41	5 54	6 07	6 23	6 32	6 42	6 54	7 08	7 15	7 23	7 31	7 41	7 51
16	5 41	5 55	6 10	6 26	6 36	6 47	6 59	7 15	7 22	7 30	7 39	7 50	8 01
20	5 42	5 57	6 12	6 29	6 40	6 51	7 05	7 21	7 29	7 38	7 47	7 58	8 11
24	5 43	5 58	6 14	6 33	6 43	6 56	7 10	7 27	7 36	7 45	7 55	8 07	8 21
28	5 44	6 00	6 17	6 36	6 47	7 00	7 15	7 33	7 42	7 51	8 02	8 15	8 30
Dec 2	5 46	6 02	6 19	6 39	6 51	7 04	7 19	7 39	7 48	7 58	8 09	8 22	8 38
6	5 47	6 04	6 22	6 42	6 54	7 08	7 24	7 43	7 53	8 03	8 15	8 29	8 45
10	5 49	6 06	6 24	6 45	6 57	7 11	7 28	7 48	7 57	8 08	8 20	8 35	8 51
14	5 51	6 08	6 27	6 48	7 00	7 14	7 31	7 51	8 01	8 12	8 25	8 39	8 56
18	5 53	6 10	6 29	6 50	7 03	7 17	7 34	7 54	8 04	8 15	8 28	8 43	9 00
22	5 55	6 13	6 31	6 52	7 05	7 19	7 36	7 57	8 06	8 18	8 30	8 45	9 03
26	5 57	6 14	6 33	6 54	7 06	7 21	7 37	7 58	8 08	8 19	8 31	8 46	9 03
30	5 59	6 16	6 34	6 55	7 08	7 22	7 38	7 59	8 08	8 19	8 32	8 46	9 03
34	6 01	6 18	6 36	6 56	7 08	7 22	7 38	7 58	8 08	8 18	8 30	8 44	9 01

BEGINNING OF MORNING TWILIGHT

Date	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 7	4 35	4 38	4 39	4 38	4 36	4 33	4 28	4 22	4 19	4 15	4 11	4 07	4 01
15	4 33	4 38	4 41	4 42	4 42	4 41	4 38	4 35	4 33	4 31	4 28	4 25	4 21
23	4 31	4 38	4 44	4 47	4 48	4 49	4 48	4 47	4 46	4 45	4 44	4 42	4 40
31	4 29	4 39	4 46	4 52	4 55	4 57	4 58	4 59	4 59	4 59	4 59	4 59	4 58
Nov. 8	4 28	4 40	4 50	4 58	5 01	5 05	5 08	5 11	5 12	5 12	5 13	5 14	5 15
16	4 29	4 42	4 53	5 03	5 08	5 13	5 17	5 22	5 23	5 25	5 27	5 29	5 31
24	4 30	4 44	4 57	5 09	5 15	5 20	5 26	5 32	5 34	5 37	5 39	5 42	5 45
Dec. 2	4 32	4 47	5 02	5 15	5 21	5 27	5 34	5 41	5 44	5 47	5 50	5 54	5 57
10	4 34	4 51	5 06	5 20	5 27	5 34	5 41	5 49	5 52	5 56	5 59	6 03	6 07
18	4 38	4 55	5 10	5 25	5 32	5 39	5 47	5 55	5 58	6 02	6 06	6 10	6 14
26	4 42	4 59	5 14	5 29	5 36	5 43	5 51	5 59	6 02	6 06	6 09	6 13	6 18
34	4 46	5 03	5 17	5 31	5 38	5 45	5 52	6 00	6 03	6 06	6 10	6 14	6 18
42	4 50	5 06	5 20	5 33	5 39	5 45	5 52	5 58	6 01	6 04	6 07	6 10	6 14

SUNSET, 2020

LOCAL MEAN TIME OF SUNSET (SUN'S UPPER LIMB) AND ENDING OF EVENING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian.

In India, to obtain I.S.T., add 4 x (82º.5 - λ) mins. or deduct 4 x (λ - 82º.5) mins. as the station is west or east of 82º.5 E. Longitude**.**

Date \ Lat.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 3	17 52	17 49	17 46	17 43	17 41	17 39	17 36	17 33	17 32	17 31	17 29	17 27	17 25
7	17 51	17 47	17 43	17 38	17 35	17 32	17 29	17 25	17 23	17 21	17 19	17 16	17 13
11	17 50	17 45	17 39	17 33	17 30	17 26	17 22	17 16	17 14	17 11	17 08	17 05	17 02
15	17 49	17 43	17 36	17 29	17 25	17 20	17 15	17 08	17 05	17 02	16 58	16 54	16 50
19	17 48	17 41	17 33	17 25	17 20	17 14	17 08	17 00	16 57	16 53	16 49	16 44	16 38
23	17 48	17 39	17 31	17 21	17 15	17 09	17 01	16 52	16 48	16 44	16 39	16 33	16 27
27	17 47	17 38	17 28	17 17	17 11	17 03	16 55	16 45	16 40	16 35	16 30	16 23	16 16
31	17 47	17 37	17 26	17 13	17 06	16 58	16 49	16 38	16 33	16 27	16 21	16 14	16 06
Nov. 4	17 47	17 36	17 24	17 10	17 03	16 54	16 44	16 31	16 26	16 19	16 12	16 04	15 55
8	17 47	17 35	17 22	17 08	16 59	16 50	16 38	16 25	16 19	16 12	16 04	15 55	15 46
12	17 48	17 35	17 21	17 05	16 56	16 46	16 34	16 19	16 13	16 05	15 57	15 47	15 36
16	17 48	17 35	17 20	17 03	16 54	16 43	16 30	16 14	16 07	15 59	15 50	15 39	15 28
20	17 49	17 35	17 19	17 02	16 52	16 40	16 26	16 10	16 02	15 53	15 44	15 32	15 20
24	17 50	17 35	17 19	17 01	16 50	16 38	16 23	16 06	15 58	15 48	15 38	15 26	15 12
28	17 52	17 36	17 19	17 00	16 49	16 36	16 21	16 03	15 54	15 44	15 33	15 21	15 06
Dec. 2	17 53	17 37	17 20	17 00	16 48	16 35	16 19	16 00	15 51	15 41	15 30	15 17	15 01
6	17 55	17 38	17 20	17 00	16 48	16 35	16 19	15 59	15 49	15 39	15 27	15 13	14 57
10	17 57	17 40	17 21	17 01	16 49	16 35	16 18	15 58	15 49	15 38	15 25	15 11	14 54
14	17 59	17 41	17 23	17 02	16 50	16 35	16 19	15 58	15 48	15 37	15 25	15 10	14 53
18	18 01	17 43	17 25	17 03	16 51	16 37	16 20	15 59	15 49	15 38	15 26	15 11	14 53
22	18 03	17 45	17 27	17 05	16 53	16 39	16 22	16 01	15 51	15 40	15 27	15 13	14 55
26	18 05	17 47	17 29	17 08	16 55	16 41	16 24	16 04	15 54	15 43	15 30	15 16	14 58
30	18 06	17 49	17 31	17 10	16 58	16 44	16 27	16 07	15 57	15 47	15 34	15 20	15 03
34	18 08	17 51	17 33	17 13	17 01	16 47	16 31	16 11	16 02	15 51	15 39	15 25	15 09

END OF EVENING TWILIGHT

Date	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 7	19 00	18 57	18 56	18 57	18 59	19 02	19 06	19 12	19 15	19 18	19 22	19 27	19 33
15	18 59	18 53	18 50	18 48	18 49	18 50	18 52	18 55	18 57	18 59	19 02	19 05	19 09
23	18 58	18 50	18 45	18 41	18 40	18 39	18 39	18 40	18 41	18 42	18 44	18 45	18 47
31	18 58	18 48	18 41	18 34	18 32	18 30	18 28	18 27	18 27	18 27	18 27	18 27	18 28
Nov. 8	18 59	18 47	18 38	18 29	18 26	18 22	18 19	18 16	18 15	18 14	18 13	18 12	18 12
16	19 01	18 48	18 36	18 26	18 21	18 17	18 12	18 07	18 06	18 04	18 02	18 00	17 58
24	19 04	18 49	18 36	18 24	18 19	18 13	18 07	18 01	17 59	17 56	17 54	17 51	17 48
Dec. 2	19 08	18 52	18 37	18 24	18 18	18 11	18 05	17 58	17 55	17 52	17 48	17 45	17 41
10	19 12	18 55	18 40	18 26	18 19	18 12	18 05	17 57	17 54	17 50	17 47	17 43	17 39
18	19 16	18 59	18 43	18 29	18 22	18 14	18 07	17 59	17 55	17 52	17 48	17 44	17 39
26	19 20	19 03	18 47	18 33	18 26	18 19	18 11	18 03	18 00	17 56	17 52	17 48	17 44
34	19 23	19 07	18 52	18 38	18 31	18 24	18 17	18 10	18 06	18 03	18 00	17 56	17 52
42	19 26	19 10	18 56	18 44	18 37	18 31	18 25	18 18	18 15	18 12	18 09	18 06	18 03

DURATION OF TWILIGHT, 2020
MORNING AND EVENING TWILIGHT: CIVIL (6º), NAUTICAL (12º)
AND ASTRONOMICAL (18º)

Date \ Lat.		0º Civ.	0º Nt.	0º Ast.	10º Civ.	10º Nt.	10º Ast.	20º Civ.	20º Nt.	20º Ast.	30º Civ.	30º Nt.	30º Ast.	40º Civ.	40º Nt.	40º Ast.
		m	m	m	m	m	m	m	m	m	m	m	m	m	m	m
Jan.	0	23	49	75	23	49	75	24	51	79	26	56	85	30	64	97
	8	22	48	74	23	49	75	24	51	78	26	56	85	30	64	96
	16	22	48	74	22	48	74	24	51	77	26	55	84	30	63	95
	24	22	47	73	22	48	73	23	50	76	25	54	83	29	62	94
Feb.	1	22	47	72	22	47	73	23	49	76	25	54	82	29	61	93
	9	21	46	71	22	47	72	23	49	75	25	53	81	28	60	92
	17	21	46	70	21	46	71	22	48	74	24	52	80	28	59	91
	25	21	45	70	21	46	70	22	48	74	24	52	80	27	59	90
Mar.	5	21	45	69	21	46	70	22	48	73	24	52	79	27	59	90
	13	21	45	69	21	45	70	22	48	73	24	52	80	27	58	90
	21	21	45	69	21	45	70	22	48	73	24	52	80	27	59	91
	29	21	45	69	21	46	70	22	48	74	24	52	81	27	59	92
Apr.	6	21	45	69	21	46	71	22	48	75	24	53	82	28	61	95
	14	21	45	70	21	46	71	23	49	76	25	54	83	28	62	97
	22	21	46	70	22	47	72	23	50	77	25	55	85	29	63	100
	30	21	46	71	22	47	73	23	50	77	25	55	87	29	65	103
May	8	22	47	72	22	48	74	23	51	79	26	57	89	30	67	108
	16	22	47	73	22	49	75	24	52	81	26	58	91	31	69	112
	24	22	48	74	23	49	76	24	53	82	27	59	93	32	71	116
June	1	22	48	74	23	50	77	24	53	83	27	60	95	32	73	119
	9	23	49	75	23	50	77	25	54	84	27	61	96	33	74	122
	17	23	49	75	23	50	78	25	54	84	28	61	97	33	75	123
	25	23	49	75	23	50	78	25	54	84	27	61	97	33	75	123
July	3	23	49	75	23	50	77	24	54	84	27	60	96	33	74	122
	11	22	48	74	23	50	77	24	53	83	27	60	95	32	73	119
	19	22	48	74	23	49	76	24	53	82	27	59	93	32	71	115
	27	22	47	73	22	49	75	24	52	80	26	58	91	31	69	111
Aug.	4	22	47	72	22	48	74	23	51	79	26	56	88	30	67	106
	12	21	46	71	22	47	73	23	50	78	25	55	86	29	65	103
	20	21	46	70	22	47	72	23	49	76	25	54	85	29	63	99
	28	21	45	70	21	46	71	22	49	75	25	53	83	28	61	96
Sept.	5	21	45	69	21	46	71	22	48	74	24	53	82	28	60	94
	13	21	45	69	21	46	70	22	48	74	24	52	81	27	59	92
	21	21	45	69	21	45	70	22	48	73	24	52	80	27	59	91
	29	21	45	69	21	45	70	22	48	73	24	52	79	27	58	90
Oct.	7	21	45	69	21	46	70	22	48	73	24	52	79	27	58	90
	15	21	45	70	21	46	70	22	48	74	24	52	80	27	59	90
	23	21	46	70	21	46	71	22	48	74	24	52	80	28	59	91
	31	21	46	71	22	47	72	23	49	75	25	53	81	28	60	92
Nov.	8	22	47	72	22	47	73	23	49	76	25	54	82	29	61	93
	16	22	47	73	22	48	73	23	50	76	25	54	83	29	62	94
	24	22	48	74	22	48	74	24	51	77	26	55	84	30	63	95
Dec.	2	22	48	74	23	49	75	24	51	78	26	56	85	30	64	96
	10	23	49	75	23	49	75	24	51	78	26	56	85	30	64	97
	18	23	49	75	23	49	75	24	52	79	26	56	86	31	65	98
	26	23	49	75	23	49	75	24	52	79	26	56	85	31	65	98
	34	23	49	75	23	49	75	24	51	78	26	56	85	30	64	97

DURATION OF TWILIGHT, 2020
MORNING AND EVENING TWILIGHT: CIVIL (6º), NAUTICAL (12º)
AND ASTRONOMICAL (18º)

Date \ Lat.		45º Civ.	45º Nt.	45º Ast.	50º Civ.	50º Nt.	50º Ast.	55º Civ.	55º Nt.	55º Ast.	60º Civ.	60º Nt.	60º Ast.
		m	m	m	m	m	m	m	m	m	m	m	m
Jan.	0	34	71	106	38	80	119	45	93	137	57	113	165
	8	33	70	105	38	78	117	44	91	135	55	111	161
	16	33	69	104	37	77	116	43	88	132	52	106	156
	24	32	68	102	36	75	113	41	86	129	50	102	151
Feb.	1	31	67	101	35	74	112	40	84	126	48	98	147
	9	31	65	100	34	72	110	39	82	124	45	95	143
	17	30	64	98	33	71	108	38	80	122	44	92	140
	25	30	64	98	33	70	108	37	79	121	42	91	139
Mar.	5	29	63	98	32	70	108	36	78	121	42	90	140
	13	29	64	98	32	70	108	36	79	121	42	90	142
	21	29	64	99	32	71	110	36	80	125	42	92	147
	29	30	65	101	33	72	113	37	81	130	43	95	155
Apr.	6	30	66	104	33	74	117	38	85	137	44	100	169
	14	31	68	108	34	77	123	39	89	147	46	107	193
	22	32	70	112	35	80	130	41	94	161	50	119	**
	30	32	72	117	36	83	139	43	100	184	53	135	**
May	8	33	76	123	38	88	151	46	110	**	59	169	**
	16	35	79	130	40	93	167	49	121	**	65	**	**
	24	36	82	137	42	99	188	52	136	**	74	**	**
June	1	36	84	144	43	104	**	54	156	**	85	**	**
	9	37	86	150	44	108	**	57	194	**	96	**	**
	17	37	87	153	45	110	**	58	**	**	106	**	**
	25	37	87	153	45	110	**	58	**	**	105	**	**
July	3	37	86	150	44	107	**	57	187	**	95	**	**
	11	36	84	144	43	103	**	54	154	**	83	**	**
	19	35	81	137	41	98	186	51	134	**	73	**	**
	27	34	78	129	40	93	165	48	120	**	64	**	**
Aug.	4	33	75	123	38	87	149	45	109	**	58	165	**
	12	32	72	116	36	82	138	42	100	182	53	134	**
	20	31	69	111	35	79	129	41	93	160	49	118	**
	28	31	67	107	34	76	122	39	88	146	46	107	192
Sept.	5	30	66	104	33	74	117	38	84	136	44	100	168
	13	30	65	101	33	72	113	37	81	130	43	95	155
	21	29	64	99	32	71	110	36	79	125	42	92	147
	29	29	63	98	32	70	108	36	78	122	41	90	142
Oct.	7	29	63	97	32	70	107	36	78	121	42	90	139
	15	30	64	98	33	70	107	37	78	121	42	90	139
	23	30	64	98	33	71	108	37	80	121	43	92	140
	31	31	65	99	34	72	109	38	81	123	45	94	142
Nov.	8	31	66	101	35	74	111	40	84	126	47	98	146
	16	32	68	102	36	75	113	41	86	129	50	102	151
	24	33	69	104	37	77	116	43	88	132	52	106	156
Dec.	2	33	70	105	38	78	117	44	91	135	55	110	161
	10	34	71	106	38	80	119	45	92	137	57	113	164
	18	34	71	107	39	80	120	46	93	138	58	115	166
	26	34	71	107	38	80	119	46	93	138	58	114	166
	34	34	71	106	38	79	119	45	92	136	56	112	163

SUNRISE, SUNSET AND TWILIGHT, 2020
CORRECTION FOR SOUTHERN LATITUDES

For	Use	Add	For	Use	Add	For	Use	Add	For	Use	Add	For	Use	Add
July	Dec.	m	Aug.	Feb.	m	Sept.	Mar.	m	Oct.	Apr.	m	Nov.	May	m
1	31	+1	7	3	-8	12	10	-14	19	16	-15	26	25	-10
July	Jan.		8	4	8	13	11	14	20	17	15	27	26	9
2	0	+1	9	5	9	14	12	14	21	18	15	28	27	9
3	1	0	10	6	9	15	13	14	22	19	15	29	28	9
4	2	0	11	7	9	16	14	14	23	20	15	30	29	9
5	3	0	12	8	9	17	15	15	24	21	14	Dec.	May	
6	4	-1	13	9	9	18	16	15	25	22	14	1	30	8
7	5	1	14	10	10	19	17	15	26	23	14	2	31	8
8	6	1	15	11	10	20	18	15	27	24	14	Dec.	June	
9	7	1	16	12	10	21	19	15	28	25	14	3	1	8
10	8	2	17	13	10	22	20	15	29	26	14	4	2	8
11	9	2	18	14	10	23	21	15	30	27	14	5	3	7
12	10	2	19	15	11	24	22	15	31	28	14	6	5	7
13	11	2	20	16	11	25	23	15	Nov.	Apr.		7	6	7
14	12	3	21	17	11	26	24	15	1	29	14	8	7	7
15	13	3	22	18	11	27	25	15	2	30	14	9	8	6
16	14	3	23	19	11	28	26	15	Nov.	May		10	9	6
17	15	3	24	19	12	29	26	15	3	1	13	11	10	6
18	16	3	25	20	12	30	27	15	4	2	13	12	11	6
19	16	4	26	21	12	Oct.	Mar.		5	3	13	13	12	5
20	17	4	27	22	12	1	28	15	6	4	13	14	13	5
21	18	4	28	23	12	2	29	15	7	5	13	15	14	5
22	19	4	29	24	12	3	30	15	8	6	13	16	15	5
23	20	5	30	25	13	4	31	15	9	7	13	17	16	4
24	21	5	31	26	13	Oct.	Apr.		10	8	12	18	17	4
25	22	5	Sept.	Feb.		5	1	16	11	9	12	19	18	4
26	23	6	1	27	13	6	2	16	12	10	12	20	19	4
27	24	6	2	28	13	7	3	16	13	11	12	21	21	3
28	25	6				8	4	15	14	12	12	22	22	3
29	26	6	Sept.	Mar.		9	5	15	15	13	12	23	23	3
30	27	7	3	1	13	10	6	15	16	14	12	24	24	3
31	28	7	4	2	13	11	7	15	17	15	11	25	25	2
Aug.	Jan.		5	3	13	12	9	15	18	17	11	26	26	2
1	29	7	6	4	14	13	10	15	19	18	11	27	27	2
2	30	7	7	5	14	14	11	15	20	19	11	28	28	2
3	30	7	8	6	14	15	12	15	21	20	11	29	29	1
4	31	8	9	7	14	16	13	15	22	21	10	30	30	1
Aug.	Feb.		10	8	14	17	14	15	23	22	10	Dec.	July	
5	1	8	11	9	14	18	15	15	24	23	10	31	1	-1
6	2	-8	12	10	-14	19	16	-15	25	24	-10	32	2	0

To obtain the times of sunrise, sunset and twilight for southern latitudes for any date, use the tables for the same northern latitude for the corresponding date given above, and apply to the times so obtained the correction given in the column headed 'Add'.

In the case of duration of twilight, however, take only the figures for the corresponding date without correction.

SUNRISE, SUNSET AND TWILIGHT, 2020
CORRECTION FOR SOUTHERN LATITUDES

For	Use	Add	For	Use	Add	For	Use	Add	For	Use	Add	For	Use	Add
Jan.	July	m	Feb.	Aug.	m	Mar.	Sept.	m	Apr.	Oct.	m	May	Nov.	m
0	1	0	5	9	+9	13	15	+14	19	22	+15	25	26	+10
1	3	0	6	10	9	14	16	14	20	23	15	26	27	9
2	4	0	7	11	9	15	17	14	21	24	14	27	28	9
			8	12	9	16	18	15	22	25	14	28	29	9
3	5	0	9	13	9	17	19	15	23	26	14	29	30	9
4	6	+1	10	14	10	18	20	15	24	27	14	May	Dec.	
5	7	1	11	15	10	19	21	15	25	28	14	30	1	8
6	8	1	12	16	10	20	22	15	26	29	14	31	2	8
7	9	1	13	17	10	21	23	15	27	30	14	June	Dec.	
8	10	2	14	18	10	22	24	15	28	31	14	1	3	8
9	11	2	15	19	11	23	25	15	Apr.	Nov.		2	4	8
10	12	2	16	20	11	24	26	15	29	1	14	3	5	7
11	13	2	17	21	11	25	27	15	30	2	14	4	5	7
12	14	3	18	22	11	26	29	15	May	Nov.		5	6	7
13	15	3	19	23	11	27	30	15	1	3	13	6	7	7
14	16	3	20	25	12	Mar.	Oct.		2	4	13	7	8	7
15	17	3	21	26	12	28	1	15	3	5	13	8	9	6
16	18	4	22	27	12	29	2	15	4	6	13	9	10	6
17	19	4	23	28	12	30	3	15	5	7	13	10	11	6
18	21	4	24	29	12	31	4	16	6	8	13	11	12	6
19	22	5	25	30	13	Apr.	Oct.		7	9	13	12	13	5
20	23	5	26	31	13	1	5	16	8	10	12	13	14	5
21	24	5				2	6	16	9	11	12	14	15	5
22	25	5	Feb.	Sept.		3	7	16	10	12	12	15	16	5
23	26	6	27	1	13	4	7	15	11	13	12	16	17	4
24	27	6	28	2	13	5	8	15	12	14	12	17	18	4
25	28	6	Mar.	Sept.		6	9	15	13	15	12	18	19	4
26	29	6	1	3	13	7	10	15	14	16	12	19	20	4
27	30	7	2	4	13	8	11	15	15	16	11	20	21	3
28	31	7	3	5	13	9	12	15	16	17	11	21	21	3
Jan.	Aug.		4	6	14	10	13	15	17	18	11	22	22	3
29	1	7	5	7	14	11	14	15	18	19	11	23	23	3
30	2	7	6	8	14	12	15	15	19	20	11	24	24	3
31	3	7	7	9	14	13	16	15	20	21	11	25	25	2
Feb.	Aug.		8	10	14	14	17	15	21	22	10	26	26	2
1	5	8	9	11	14	15	18	15	22	23	10	27	27	2
2	6	8	10	12	14	16	19	15	23	24	10	28	28	1
3	7	8	11	13	14	17	20	15	24	25	10	29	29	1
4	8	+9	12	14	+14	18	21	+15	25	26	+10	30	30	+1

To obtain the times of sunrise, sunset and twilight for southern latitudes for any date, use the tables for the same northern latitude for the corresponding date given above, and apply to the times so obtained the correction given in the column headed 'Add'.

In the case of duration of twilight, however, take only the figures for the corresponding date without correction.

SUNRISE AND SUNSET, 2020
INDIAN STANDARD TIME OF SUNRISE AND SUNSET (SUN'S UPPER LIMB)
FOR CERTAIN STATIONS IN INDIA

Date		Kolkata 22º N 32'		Varanasi 25º N 18'		Chennai 13º N 00'		Delhi 28º N 35'		Mumbai 18º N 54'	
		Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	1	6 16.5	17 03.2	6 43.5	17 18.9	6 31.1	17 53.4	7 14.2	17 35.0	7 12.0	18 11.9
	3	6 17.1	17 04.5	6 44.1	17 20.3	6 32.0	17 54.8	7 14.7	17 36.6	7 12.6	18 13.3
	5	6 17.7	17 05.8	6 44.5	17 21.7	6 32.7	17 56.0	7 15.1	17 38.1	7 13.2	18 14.5
	7	6 18.1	17 07.2	6 44.9	17 23.1	6 33.3	17 57.1	7 15.4	17 39.6	7 13.7	18 15.8
	9	6 18.5	17 08.5	6 45.2	17 24.6	6 33.9	17 58.2	7 15.6	17 41.1	7 14.2	18 17.0
	11	6 18.7	17 09.9	6 45.4	17 26.0	6 34.4	17 59.3	7 15.6	17 42.7	7 14.5	18 18.3
	13	6 18.9	17 11.3	6 45.5	17 27.5	6 34.9	18 00.4	7 15.6	17 44.3	7 14.8	18 19.6
	15	6 19.0	17 12.8	6 45.5	17 29.0	6 35.3	18 01.5	7 15.5	17 45.9	7 15.0	18 20.9
	17	6 19.0	17 14.2	6 45.4	17 30.5	6 35.6	18 02.5	7 15.2	17 47.5	7 15.1	18 22.1
	19	6 18.9	17 15.6	6 45.1	17 32.1	6 35.8	18 03.6	7 14.9	17 49.1	7 15.2	18 23.4
	21	6 18.7	17 17.0	6 44.8	17 33.6	6 36.0	18 04.6	7 14.4	17 50.8	7 15.1	18 24.7
	23	6 18.4	17 18.4	6 44.4	17 35.1	6 36.1	18 05.6	7 13.9	17 52.4	7 15.0	18 25.9
	25	6 18.0	17 19.8	6 43.9	17 36.6	6 36.1	18 06.5	7 13.2	17 54.1	7 14.8	18 27.1
	27	6 17.6	17 21.2	6 43.3	17 38.1	6 36.1	18 07.5	7 12.4	17 55.7	7 14.5	18 28.3
	29	6 17.0	17 22.5	6 42.6	17 39.6	6 35.9	18 08.4	7 11.5	17 57.4	7 14.1	18 29.5
	31	6 16.4	17 23.9	6 41.8	17 41.1	6 35.7	18 09.2	7 10.6	17 59.0	7 13.6	18 30.7
Feb.	2	6 15.7	17 25.2	6 40.9	17 42.5	6 35.5	18 10.1	7 09.5	18 00.6	7 13.0	18 31.8
	4	6 14.8	17 26.5	6 40.0	17 43.9	6 35.1	18 10.9	7 08.3	18 02.2	7 12.4	18 32.9
	6	6 14.0	17 27.7	6 38.9	17 45.3	6 34.7	18 11.6	7 07.1	18 03.7	7 11.7	18 33.9
	8	6 13.0	17 29.0	6 37.8	17 46.7	6 34.2	18 12.3	7 05.7	18 05.3	7 10.9	18 35.0
	10	6 12.0	17 30.2	6 36.6	17 48.0	6 33.7	18 13.0	7 04.3	18 06.8	7 10.0	18 36.0
	12	6 10.8	17 31.3	6 35.3	17 49.3	6 33.1	18 13.6	7 02.8	18 08.3	7 09.1	18 36.9
	14	6 09.7	17 32.5	6 33.9	17 50.6	6 32.4	18 14.2	7 01.2	18 09.8	7 08.1	18 37.9
	16	6 08.4	17 33.6	6 32.5	17 51.9	6 31.7	18 14.8	7 00.0	18 11.3	7 07.1	18 38.8
	18	6 07.1	17 34.6	6 31.0	17 53.1	6 30.9	18 15.3	6 57.8	18 12.7	7 05.9	18 39.6
	20	6 05.7	17 35.7	6 29.4	17 54.3	6 30.0	18 15.8	6 56.0	18 14.1	7 04.7	18 40.4
	22	6 04.3	17 36.7	6 27.8	17 55.4	6 29.1	18 16.3	6 54.2	18 15.5	7 03.5	18 41.2
	24	6 02.8	17 37.7	6 26.1	17 56.6	6 28.2	18 16.7	6 52.2	18 16.9	7 02.2	18 42.0
	26	6 01.3	17 38.6	6 24.4	17 57.7	6 27.2	18 17.1	6 50.3	18 18.2	7 00.8	18 42.7
	28	6 00.0	17 39.5	6 22.6	17 58.8	6 26.1	18 17.4	6 48.2	18 19.5	6 59.4	18 43.5
Mar.	1	5 58.1	17 40.4	6 20.8	18 00.0	6 25.1	18 17.8	6 46.2	18 20.8	6 58.0	18 44.1
	3	5 56.5	17 41.3	6 18.9	18 00.9	6 23.9	18 18.1	6 44.1	18 22.1	6 56.5	18 44.8
	5	5 54.8	17 42.1	6 17.0	18 01.9	6 22.8	18 18.3	6 41.9	18 23.4	6 55.0	18 45.4
	7	5 53.0	17 42.9	6 15.1	18 02.8	6 21.6	18 18.6	6 39.7	18 24.6	6 53.4	18 46.0
	9	5 51.3	17 43.7	6 13.1	18 03.8	6 20.4	18 18.8	6 37.5	18 25.8	6 51.9	18 46.6
	11	5 49.5	17 44.5	6 11.1	18 04.8	6 19.2	18 19.0	6 35.3	18 27.0	6 50.3	18 47.2
	13	5 47.7	17 45.3	6 09.1	18 05.7	6 17.9	18 19.2	6 33.0	18 28.2	6 48.6	18 47.7
	15	5 45.8	17 46.0	6 07.1	18 06.6	6 16.6	18 19.4	6 30.7	18 29.3	6 47.0	18 48.2
	17	5 43.9	17 46.8	6 05.1	18 07.5	6 15.3	18 19.5	6 28.4	18 30.5	6 45.3	18 48.7
	19	5 42.1	17 47.5	6 03.0	18 08.4	6 14.0	18 19.7	6 26.1	18 31.6	6 43.6	18 49.2
	21	5 40.2	17 48.2	6 01.0	18 09.3	6 12.7	18 19.8	6 23.8	18 32.8	6 41.9	18 49.7
	23	5 38.3	17 48.9	5 59.0	18 10.2	6 11.4	18 19.9	6 21.5	18 33.9	6 40.2	18 50.2
	25	5 36.4	17 49.6	5 56.9	18 11.1	6 10.1	18 20.0	6 19.2	18 35.0	6 38.6	18 50.7
	27	5 34.5	17 50.3	5 54.8	18 12.0	6 08.8	18 20.2	6 16.9	18 36.1	6 36.9	18 51.2
	29	5 32.5	17 51.0	5 52.8	18 12.8	6 07.5	18 20.3	6 14.6	18 37.3	6 35.2	18 51.7
	31	5 30.6	17 51.7	5 50.7	18 13.7	6 06.2	18 20.4	6 12.3	18 38.4	6 33.5	18 52.1
Apr.	2	5 28.8	17 52.4	5 48.7	18 14.6	6 04.9	18 20.5	6 10.0	18 39.5	6 31.8	18 52.6

SUNRISE AND SUNSET, 2020
INDIAN STANDARD TIME OF SUNRISE AND SUNSET (SUN'S UPPER LIMB)
FOR CERTAIN STATIONS IN INDIA

Date		Kolkata 22º N 32'		Varanasi 25º N 18'		Chennai 13º N 00'		Delhi 28º N 35'		Mumbai 18º N 54'	
		Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	2	5 28.8	17 52.4	5 48.7	18 14.6	6 04.9	18 20.5	6 10.0	18 39.5	6 31.8	18 52.6
	4	5 26.9	17 53.1	5 46.7	18 15.5	6 03.6	18 20.7	6 07.8	18 40.6	6 30.2	18 53.1
	6	5 25.0	17 53.8	5 44.7	18 16.3	6 02.3	18 20.8	6 05.6	18 41.7	6 28.5	18 53.6
	8	5 23.2	17 54.5	5 42.7	18 17.2	6 01.1	18 21.0	6 03.4	18 42.8	6 26.9	18 54.1
	10	5 21.4	17 55.2	5 40.7	18 18.1	6 00.0	18 21.1	6 01.2	18 44.0	6 25.3	18 54.6
	12	5 19.6	17 55.9	5 38.7	18 19.0	5 58.7	18 21.3	5 59.1	18 45.1	6 23.8	18 55.1
	14	5 17.8	17 56.6	5 36.8	18 19.9	5 57.5	18 21.5	5 57.0	18 46.3	6 22.3	18 55.7
	16	5 16.1	17 57.4	5 34.9	18 20.9	5 56.4	18 21.7	5 54.9	18 47.4	6 20.8	18 56.2
	18	5 14.4	17 58.1	5 33.1	18 21.8	5 55.2	18 21.9	5 52.9	18 48.6	6 19.3	18 56.8
	20	5 12.7	17 58.9	5 31.3	18 22.7	5 54.2	18 22.2	5 50.9	18 49.7	6 17.9	18 57.3
	22	5 11.1	18 00.0	5 29.5	18 23.7	5 53.1	18 22.5	5 49.0	18 50.9	6 16.5	18 57.9
	24	5 09.6	18 00.4	5 27.8	18 24.7	5 52.1	18 22.7	5 47.1	18 52.1	6 15.2	18 58.5
	26	5 08.1	18 01.2	5 26.2	18 25.6	5 51.1	18 23.1	5 45.2	18 53.3	6 13.9	18 59.2
	28	5 06.6	18 02.1	5 24.5	18 26.6	5 50.2	18 23.4	5 43.5	18 54.5	6 12.7	19 00.0
	30	5 05.2	18 02.9	5 23.0	18 27.6	5 49.3	18 23.7	5 41.7	18 55.7	6 11.5	19 00.5
May	2	5 03.8	18 03.7	5 21.5	18 28.6	5 48.5	18 24.1	5 40.1	18 56.9	6 10.4	19 01.1
	4	5 02.6	18 04.6	5 20.1	18 29.7	5 47.7	18 24.5	5 38.4	18 58.2	6 09.3	19 01.8
	6	5 01.3	18 05.5	5 18.7	18 30.7	5 47.0	18 24.9	5 36.9	18 59.4	6 08.3	19 02.5
	8	5 00.2	18 06.3	5 17.4	18 31.7	5 46.3	18 25.4	5 35.4	19 00.6	6 07.3	19 03.3
	10	4 59.1	18 07.2	5 16.2	18 32.8	5 45.6	18 25.9	5 34.1	19 01.8	6 06.5	19 04.0
	12	4 58.1	18 08.1	5 15.0	18 33.8	5 45.1	18 26.3	5 32.7	19 03.1	6 05.6	19 04.8
	14	4 57.1	18 09.0	5 13.9	18 34.9	5 44.5	18 26.9	5 31.5	19 04.3	6 04.9	19 05.5
	16	4 56.3	18 09.9	5 12.9	18 35.9	5 44.1	18 27.4	5 30.3	19 05.5	6 04.2	19 06.3
	18	4 55.4	18 10.8	5 12.0	18 37.0	5 43.7	18 27.9	5 29.3	19 06.7	6 03.5	19 07.1
	20	4 54.7	18 11.8	5 11.2	18 38.0	5 43.3	18 28.5	5 28.3	19 07.9	6 03.0	19 07.9
	22	4 54.1	18 12.7	5 10.4	18 39.1	5 43.0	18 29.1	5 27.4	19 09.1	6 02.5	19 08.6
	24	4 53.5	18 13.6	5 09.7	18 40.1	5 42.8	18 29.6	5 26.6	19 10.2	6 02.1	19 09.4
	26	4 53.0	18 14.5	5 09.1	18 41.1	5 42.6	18 30.2	5 25.9	19 11.4	6 01.7	19 10.2
	28	4 52.6	18 15.3	5 08.6	18 42.1	5 42.5	18 30.8	5 25.2	19 12.5	6 01.4	19 11.0
	30	4 52.2	18 16.2	5 08.2	18 43.0	5 42.4	18 31.5	5 24.7	19 13.5	6 01.2	19 11.8
June	1	4 52.0	18 17.0	5 07.8	18 44.0	5 42.4	18 32.1	5 24.2	19 14.6	6 01.0	19 12.5
	3	4 51.8	18 17.9	5 07.6	18 44.9	5 42.4	18 32.7	5 23.9	19 15.6	6 00.9	19 13.3
	5	4 51.7	18 18.6	5 07.4	18 45.7	5 42.5	18 33.3	5 23.6	19 16.5	6 00.9	19 14.0
	7	4 51.6	18 19.4	5 07.3	18 46.6	5 42.7	18 33.9	5 23.4	19 17.4	6 00.9	19 14.7
	9	4 51.6	18 20.1	5 07.3	18 47.3	5 42.8	18 34.4	5 23.4	19 18.3	6 01.0	19 15.4
	11	4 51.7	18 20.8	5 07.3	18 48.1	5 43.1	18 35.0	5 23.4	19 19.1	6 01.2	19 16.0
	13	4 51.9	18 21.5	5 07.5	18 48.8	5 43.3	18 35.6	5 23.4	19 19.8	6 01.4	19 16.6
	15	4 52.1	18 22.1	5 07.7	18 49.4	5 43.7	18 36.1	5 23.6	19 20.5	6 01.6	19 17.2
	17	4 52.4	18 22.6	5 07.9	18 50.0	5 44.0	18 36.6	5 23.9	19 21.1	6 01.9	19 17.7
	19	4 52.8	18 23.1	5 08.3	18 50.5	5 44.4	18 37.1	5 24.2	19 21.6	6 02.3	19 18.2
	21	4 53.2	18 23.6	5 08.7	18 51.0	5 44.8	18 37.5	5 24.6	19 22.0	6 02.7	19 18.7
	23	4 53.7	18 24.0	5 09.2	18 51.3	5 45.3	18 37.9	5 25.1	19 22.4	6 03.2	19 19.1
	25	4 54.2	18 24.3	5 09.7	18 51.7	5 45.7	18 38.3	5 25.6	19 22.7	6 03.7	19 19.4
	27	4 54.8	18 24.5	5 10.3	18 51.9	5 46.2	18 38.6	5 26.2	19 22.9	6 04.2	19 19.7
	29	4 55.4	18 24.7	5 10.9	18 52.1	5 46.7	18 38.9	5 26.9	19 23.0	6 04.7	19 19.9
July	1	4 56.0	18 24.9	5 11.6	18 52.1	5 47.3	18 39.1	5 27.6	19 23.1	6 05.3	19 20.1
	3	4 56.7	18 24.9	5 12.3	18 52.1	5 47.8	18 39.3	5 28.4	19 23.0	6 06.0	19 20.2

SUNRISE AND SUNSET, 2020

INDIAN STANDARD TIME OF SUNRISE AND SUNSET (SUN'S UPPER LIMB) FOR CERTAIN STATIONS IN INDIA

Date		Kolkata 22º N 32'		Varanasi 25º N 18'		Chennai 13º N 00'		Delhi 28º N 35'		Mumbai 18º N 54'	
		Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	1	4 56.0	18 24.9	5 11.6	18 52.1	5 47.3	18 39.1	5 27.6	19 23.1	6 05.3	19 20.1
	3	4 56.7	18 24.9	5 12.3	18 52.1	5 47.8	18 39.3	5 28.4	19 23.0	6 06.0	19 20.2
	5	4 57.4	18 24.9	5 13.1	18 52.1	5 48.4	18 39.5	5 29.3	19 22.9	6 06.6	19 20.3
	7	4 58.2	18 24.8	5 13.9	18 51.9	5 48.9	18 39.6	5 30.1	19 22.6	6 07.3	19 20.2
	9	4 59.0	18 24.6	5 14.8	18 51.6	5 49.5	18 39.6	5 31.1	19 22.3	6 07.9	19 20.1
	11	5 00.0	18 24.4	5 15.6	18 51.3	5 50.0	18 39.6	5 32.0	19 21.9	6 08.6	19 20.0
	13	5 00.6	18 24.0	5 16.5	18 50.9	5 50.6	18 39.5	5 33.0	19 21.3	6 09.3	19 19.7
	15	5 01.4	18 23.6	5 17.5	18 50.4	5 51.1	18 39.4	5 34.0	19 20.7	6 10.0	19 19.4
	17	5 02.3	18 23.1	5 18.4	18 49.8	5 51.7	18 39.2	5 35.1	19 20.0	6 10.7	19 19.1
	19	5 03.1	18 22.6	5 19.3	18 49.1	5 52.2	18 38.9	5 36.1	19 19.2	6 11.5	19 18.6
	21	5 04.0	18 21.9	5 20.3	18 48.4	5 52.7	18 38.6	5 37.2	19 18.3	6 12.2	19 18.1
	23	5 04.8	18 21.2	5 21.3	18 47.5	5 53.2	18 38.2	5 38.3	19 17.3	6 12.9	19 17.5
	25	5 05.7	18 20.4	5 22.2	18 46.6	5 53.7	18 37.8	5 39.4	19 16.2	6 13.6	19 16.8
	27	5 06.5	18 19.5	5 23.2	18 45.6	5 54.1	18 37.3	5 40.5	19 15.1	6 14.3	19 16.1
	29	5 07.4	18 18.6	5 24.2	18 44.5	5 54.6	18 36.7	5 41.7	19 13.8	6 14.9	19 15.3
	31	5 08.2	18 17.6	5 25.1	18 43.3	5 55.0	18 36.1	5 42.8	19 12.5	6 15.6	19 14.4
Aug.	2	5 09.1	18 16.5	5 26.1	18 42.1	5 55.4	18 35.4	5 43.9	19 11.1	6 16.2	19 13.5
	4	5 09.9	18 15.3	5 27.1	18 40.8	5 55.8	18 34.7	5 45.0	19 09.6	6 16.9	19 12.5
	6	5 10.7	18 14.1	5 28.0	18 39.4	5 56.1	18 33.9	5 46.1	19 08.0	6 17.5	19 11.4
	8	5 11.5	18 12.8	5 28.9	18 37.9	5 56.4	18 33.1	5 47.2	19 06.4	6 18.1	19 10.3
	10	5 12.3	18 11.5	5 29.9	18 36.4	5 56.7	18 32.2	5 48.3	19 04.6	6 18.7	19 09.1
	12	5 13.0	18 10.1	5 30.8	18 34.8	5 57.0	18 31.3	5 49.4	19 02.9	6 19.2	19 07.9
	14	5 13.8	18 08.6	5 31.7	18 33.2	5 57.3	18 30.3	5 50.5	19 01.0	6 19.8	19 06.6
	16	5 14.5	18 07.1	5 32.6	18 31.5	5 57.5	18 29.2	5 51.6	18 59.1	6 20.3	19 05.2
	18	5 15.2	18 05.5	5 33.4	18 29.8	5 57.7	18 28.1	5 52.6	18 57.1	6 20.8	19 03.8
	20	5 15.9	18 03.9	5 34.3	18 28.0	5 57.8	18 27.0	5 53.7	18 55.1	6 21.3	19 02.4
	22	5 16.6	18 02.3	5 35.1	18 26.1	5 58.0	18 25.9	5 54.7	18 53.0	6 21.8	19 00.9
	24	5 17.3	18 00.6	5 35.9	18 24.2	5 58.1	18 24.7	5 55.7	18 50.9	6 22.2	18 59.4
	26	5 17.9	17 58.9	5 36.8	18 22.3	5 58.2	18 23.4	5 56.7	18 48.7	6 22.7	18 57.8
	28	5 18.6	17 57.1	5 37.6	18 20.3	5 58.3	18 22.2	5 57.7	18 46.5	6 23.1	18 56.2
	30	5 19.2	17 55.3	5 38.3	18 18.3	5 58.4	18 20.9	5 58.7	18 44.3	6 23.5	18 54.5
Sept.	1	5 19.8	17 53.5	5 39.1	18 16.3	5 58.5	18 19.6	6 00.0	18 42.0	6 23.9	18 52.9
	3	5 20.4	17 51.6	5 39.9	18 14.2	5 58.5	18 18.2	6 00.6	18 39.7	6 24.3	18 51.2
	5	5 21.0	17 49.7	5 40.7	18 12.2	5 58.6	18 16.9	6 01.6	18 37.4	6 24.6	18 49.5
	7	5 21.6	17 47.8	5 41.4	18 10.1	5 58.6	18 15.5	6 02.6	18 35.0	6 25.0	18 47.7
	9	5 22.2	17 45.8	5 42.2	18 08.0	5 58.6	18 14.1	6 03.5	18 32.7	6 25.3	18 46.0
	11	5 22.7	17 43.9	5 42.9	18 05.8	5 58.6	18 12.7	6 04.5	18 30.3	6 25.7	18 44.2
	13	5 23.3	17 41.9	5 43.6	18 03.7	5 58.6	18 11.3	6 05.4	18 27.9	6 26.0	18 42.4
	15	5 23.9	17 39.9	5 44.4	18 01.6	5 58.6	18 09.9	6 06.4	18 25.5	6 26.4	18 40.6
	17	5 24.5	17 37.9	5 45.1	17 59.4	5 58.6	18 08.5	6 07.3	18 23.1	6 26.7	18 38.8
	19	5 25.0	17 35.9	5 45.9	17 57.3	5 58.6	18 07.1	6 08.3	18 20.7	6 27.1	18 37.0
	21	5 25.6	17 33.9	5 46.6	17 55.2	5 58.6	18 05.7	6 09.3	18 18.3	6 27.4	18 35.3
	23	5 26.2	17 31.9	5 47.4	17 53.0	5 58.6	18 04.3	6 10.2	18 15.9	6 27.8	18 33.5
	25	5 26.8	17 29.9	5 48.2	17 50.9	5 58.7	18 02.9	6 11.2	18 13.5	6 28.2	18 31.7
	27	5 27.4	17 28.0	5 48.9	17 48.8	5 58.7	18 01.5	6 12.2	18 11.2	6 28.6	18 30.0
	29	5 28.0	17 26.0	5 49.7	17 46.7	5 58.7	18 00.1	6 13.3	18 08.9	6 29.0	18 28.2
Oct.	1	5 28.7	17 24.0	5 50.5	17 44.6	5 58.8	17 58.8	6 14.3	18 06.6	6 29.4	18 26.5

SUNRISE AND SUNSET, 2020

INDIAN STANDARD TIME OF SUNRISE AND SUNSET (SUN'S UPPER LIMB)
FOR CERTAIN STATIONS IN INDIA

Date		Kolkata 22º N 32'		Varanasi 25º N 18'		Chennai 13º N 00'		Delhi 28º N 35'		Mumbai 18º N 54'	
		Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	1	5 28.7	17 24.0	5 50.5	17 44.6	5 58.8	17 58.8	6 14.3	18 06.6	6 29.4	18 26.5
	3	5 29.2	17 22.6	5 51.2	17 43.0	5 58.6	17 57.6	6 15.0	18 04.8	6 29.6	18 25.2
	5	5 29.8	17 20.7	5 52.0	17 40.9	5 58.7	17 56.3	6 16.1	18 02.5	6 30.1	18 23.5
	7	5 30.5	17 18.8	5 52.8	17 38.9	5 58.8	17 55.0	6 17.2	18 00.3	6 30.5	18 21.9
	9	5 31.2	17 17.0	5 53.7	17 36.9	5 59.0	17 53.7	6 18.3	17 58.1	6 31.0	18 20.2
	11	5 32.0	17 15.2	5 54.6	17 34.9	5 59.1	17 52.5	6 19.4	17 55.9	6 31.6	18 18.7
	13	5 32.7	17 13.4	5 55.5	17 33.0	5 59.3	17 51.3	6 20.6	17 53.8	6 32.1	18 17.1
	15	5 33.5	17 11.7	5 56.5	17 31.1	5 59.6	17 50.2	6 21.8	17 51.7	6 32.7	18 15.7
	17	5 34.3	17 10.0	5 57.5	17 29.2	5 59.8	17 49.1	6 23.0	17 49.7	6 33.3	18 14.2
	19	5 35.2	17 08.3	5 58.5	17 27.4	6 00.1	17 48.0	6 24.2	17 47.7	6 33.9	18 12.8
	21	5 36.0	17 06.7	5 59.5	17 25.7	6 00.4	17 47.0	6 25.5	17 45.8	6 34.6	18 11.5
	23	5 36.9	17 05.2	6 00.5	17 24.0	6 00.8	17 46.0	6 26.8	17 43.9	6 35.3	18 10.2
	25	5 37.9	17 03.8	6 01.6	17 22.4	6 01.2	17 45.1	6 28.1	17 42.1	6 36.0	18 09.0
	27	5 38.8	17 02.4	6 02.7	17 20.8	6 01.6	17 44.3	6 29.4	17 40.3	6 36.8	18 07.8
	29	5 39.8	17 01.0	6 03.9	17 19.3	6 02.1	17 43.5	6 30.8	17 38.6	6 37.6	18 06.7
	31	5 40.9	16 59.8	6 05.1	17 17.9	6 02.6	17 42.8	6 32.2	17 37.0	6 38.4	18 05.7
Nov.	2	5 41.9	16 58.6	6 06.3	17 16.6	6 03.2	17 42.1	6 33.7	17 35.5	6 39.3	18 04.7
	4	5 43.0	16 57.5	6 07.5	17 15.3	6 03.7	17 41.5	6 35.1	17 34.0	6 40.2	18 03.8
	6	5 44.1	16 56.4	6 08.8	17 14.1	6 04.4	17 40.9	6 36.6	17 32.6	6 41.1	18 03.0
	8	5 45.3	16 55.5	6 10.1	17 13.0	6 05.1	17 40.5	6 38.2	17 31.3	6 42.1	18 02.3
	10	5 46.5	16 54.6	6 11.4	17 12.0	6 05.8	17 40.1	6 39.7	17 30.1	6 43.2	18 01.6
	12	5 47.7	16 53.8	6 12.8	17 11.0	6 06.5	17 39.8	6 41.3	17 29.0	6 44.2	18 01.0
	14	5 48.9	16 53.1	6 14.1	17 10.2	6 07.3	17 39.5	6 42.8	17 28.0	6 45.3	18 00.5
	16	5 50.2	16 52.5	6 15.5	17 09.5	6 08.2	17 39.3	6 44.4	17 27.1	6 46.4	18 00.1
	18	5 51.4	16 52.0	6 16.9	17 08.8	6 09.0	17 39.2	6 46.0	17 26.3	6 47.5	17 59.8
	20	5 52.7	16 51.6	6 18.4	17 08.3	6 09.9	17 39.2	6 47.6	17 25.6	6 48.7	17 59.5
	22	5 54.0	16 51.3	6 19.8	17 07.9	6 10.9	17 39.3	6 49.3	17 25.0	6 49.9	17 59.3
	24	5 55.4	16 51.1	6 21.2	17 07.5	6 11.9	17 39.4	6 50.9	17 24.6	6 51.1	17 59.3
	26	5 56.7	16 50.9	6 22.7	17 07.3	6 12.9	17 39.6	6 52.5	17 24.2	6 52.3	17 59.3
	28	5 58.0	16 50.9	6 24.1	17 07.1	6 13.9	17 39.9	6 54.1	17 23.9	6 53.6	17 59.4
	30	5 59.3	16 51.0	6 25.6	17 07.1	6 14.9	17 40.2	6 55.7	17 23.8	6 54.8	17 59.5
Dec.	2	6 00.6	16 51.1	6 27.0	17 07.2	6 16.0	17 40.6	6 57.2	17 23.7	6 56.1	17 59.8
	4	6 01.9	16 51.4	6 28.4	17 07.4	6 17.1	17 41.1	6 58.8	17 23.8	6 57.3	18 00.1
	6	6 03.2	16 51.7	6 29.8	17 07.6	6 18.1	17 41.7	7 00.3	17 24.0	6 58.6	18 00.5
	8	6 04.5	16 52.1	6 31.2	17 08.0	6 19.2	17 42.3	7 01.7	17 24.3	6 59.8	18 01.0
	10	6 05.8	16 52.7	6 32.5	17 08.5	6 20.3	17 43.0	7 03.1	17 24.7	7 01.0	18 01.6
	12	6 07.0	16 53.3	6 33.8	17 09.0	6 21.4	17 43.7	7 04.5	17 25.2	7 02.2	18 02.3
	14	6 08.2	16 54.0	6 35.1	17 09.7	6 22.5	17 44.5	7 05.8	17 25.8	7 03.4	18 03.0
	16	6 09.3	16 54.7	6 36.3	17 10.4	6 23.6	17 45.4	7 07.1	17 26.5	7 04.5	18 03.8
	18	6 10.4	16 55.6	6 37.4	17 11.3	6 24.6	17 46.3	7 08.3	17 27.3	7 05.7	18 04.6
	20	6 11.5	16 56.5	6 38.5	17 12.2	6 25.7	17 47.2	7 09.4	17 28.2	7 06.7	18 05.5
	22	6 12.5	16 57.5	6 39.6	17 13.2	6 26.7	17 48.2	7 10.4	17 29.2	7 07.8	18 06.5
	24	6 13.5	16 58.6	6 40.5	17 14.2	6 27.7	17 49.2	7 11.4	17 30.2	7 08.7	18 07.5
	26	6 14.4	16 59.7	6 41.4	17 15.4	6 28.6	17 50.3	7 12.3	17 31.4	7 09.7	18 08.6
	28	6 15.2	17 00.9	6 42.2	17 16.5	6 29.5	17 51.3	7 13.0	17 32.6	7 10.5	18 09.7
	30	6 15.9	17 02.1	6 43.0	17 17.8	6 30.4	17 52.4	7 13.7	17 33.9	7 11.3	18 10.9
	32	6 16.6	17 03.3	6 43.6	17 19.1	6 31.2	17 53.5	7 14.3	17 35.2	7 12.1	18 12.0

MOONRISE, 2020
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.														FOR CERTAIN STATIONS IN INDIA IN I.S.T							
Date \ Lat.		0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Jan.	0	10	03	10	13	10	23	10	35	10	50	11	09	10	02	10	25	10	55	11	02
	1	10	46	10	52	10	59	11	07	11	17	11	30	10	37	11	04	11	28	11	38
	2	11	27	11	30	11	33	11	37	11	42	11	49	11	11	11	41	11	59	12	13
	3	12	08	12	07	12	07	12	07	12	07	12	06	11	43	12	17	12	29	12	47
	4	12	49	12	45	12	41	12	37	12	31	12	24	12	16	12	53	12	59	13	21
	5	13	31	13	24	13	17	13	08	12	58	12	43	12	51	13	32	13	31	13	57
	6	14	17	14	06	13	55	13	42	13	27	13	06	13	28	14	12	14	06	14	36
	7	15	05	14	51	14	37	14	21	14	00	13	32	14	09	14	57	14	45	15	18
	8	15	57	15	41	15	24	15	05	14	40	14	06	14	55	15	46	15	30	16	06
	9	16	53	16	36	16	17	15	55	15	28	14	49	15	47	16	40	16	21	16	59
	10	17	52	17	34	17	15	16	53	16	25	15	45	16	45	17	38	17	18	17	57
	11	18	52	18	35	18	17	17	56	17	29	16	52	17	47	18	39	18	21	18	59
	12	19	51	19	36	19	20	19	02	18	40	18	08	18	52	19	41	19	28	20	02
	13	20	48	20	36	20	24	20	10	19	53	19	29	19	56	20	42	20	35	21	05
	14	21	42	21	34	21	26	21	17	21	06	20	50	21	00	21	42	21	41	22	07
	15	22	33	22	30	22	27	22	23	22	18	22	11	22	01	22	39	22	46	23	07
	16	23	24	23	25	23	26	23	27	23	29	23	31	23	02	23	35	23	49	**	**
	17	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0	06
	18	0	13	0	19	0	24	0	30	0	38	0	49	0	01	0	30	0	52	1	04
	19	1	03	1	13	1	22	1	33	1	47	2	07	1	01	1	25	1	54	2	01
	20	1	55	2	07	2	21	2	36	2	56	3	23	2	00	2	21	2	56	3	00
	21	2	48	3	03	3	19	3	38	4	02	4	36	3	00	3	17	3	58	3	58
	22	3	42	3	59	4	17	4	39	5	06	5	44	3	58	4	14	4	58	4	56
	23	4	36	4	54	5	13	5	36	6	04	6	44	4	54	5	09	5	54	5	51
	24	5	30	5	47	6	06	6	28	6	55	7	34	5	47	6	02	6	47	6	44
	25	6	21	6	37	6	55	7	15	7	39	8	14	6	35	6	52	7	34	7	33
	26	7	10	7	24	7	39	7	56	8	17	8	46	7	19	7	38	8	16	8	17
	27	7	57	8	08	8	20	8	33	8	50	9	12	7	59	8	21	8	53	8	58
	28	8	41	8	48	8	57	9	06	9	18	9	34	8	35	9	00	9	27	9	36
	29	9	22	9	27	9	32	9	37	9	44	9	53	9	09	9	38	9	59	10	11
	30	10	03	10	04	10	06	10	07	10	09	10	11	9	42	10	14	10	29	10	45
	31	10	44	10	42	10	39	10	36	10	33	10	28	10	15	10	50	10	59	11	19
Feb.	1	11	25	11	20	11	13	11	06	10	58	10	47	10	48	11	27	11	30	11	53
	2	12	08	11	59	11	50	11	39	11	25	11	07	11	23	12	06	12	02	12	30
	3	12	54	12	42	12	29	12	14	11	56	11	31	12	01	12	48	12	39	13	10
	4	13	44	13	29	13	13	12	54	12	32	12	00	12	44	13	34	13	19	13	54
	5	14	37	14	20	14	02	13	41	13	15	12	38	13	32	14	24	14	06	14	43
	6	15	34	15	16	14	56	14	34	14	06	13	26	14	27	15	20	15	00	15	38
	7	16	33	16	15	15	56	15	34	15	07	14	27	15	27	16	19	16	00	16	38
	8	17	33	17	17	17	00	16	40	16	15	15	40	16	31	17	22	17	06	17	42
	9	18	32	18	19	18	05	17	49	17	29	17	01	17	37	18	25	18	14	18	47
	10	19	29	19	20	19	10	18	59	18	45	18	26	18	43	19	27	19	23	19	52
	11	20	24	20	19	20	14	20	08	20	00	19	50	19	48	20	27	20	31	20	55
	12	21	17	21	16	21	16	21	15	21	14	21	13	20	51	21	26	21	38	21	56
	13	22	08	22	12	22	16	22	21	22	27	22	35	21	53	22	23	22	43	22	56
	14	23	00	23	08	23	16	23	26	23	38	23	55	22	54	23	20	23	47	23	56
	15	23	52	**	**	**	**	**	**	**	**	**	**	23	55	**	**	**	**	**	**

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2020
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Jan.	0	22	24	22	15	22	06	21	56	21	44	21	26	21	40	22	22	22	20	22	47
	1	23	06	23	01	22	55	22	49	22	42	22	31	22	29	23	08	23	12	23	36
	2	23	47	23	45	23	43	23	42	23	39	23	36	23	19	23	54	**	**	**	**
	3	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0	04	0	23
	4	0	27	0	29	0	31	0	34	0	37	0	41	0	08	0	40	0	56	1	11
	5	1	09	1	15	1	20	1	27	1	35	1	47	0	58	1	26	1	48	2	00
	6	1	53	2	02	2	11	2	22	2	36	2	54	1	50	2	14	2	43	2	50
	7	2	39	2	52	3	04	3	19	3	38	4	04	2	44	3	05	3	40	3	43
	8	3	30	3	45	4	01	4	19	4	42	5	15	3	41	3	59	4	39	4	39
	9	4	24	4	41	4	59	5	20	5	46	6	24	4	40	4	56	5	39	5	37
	10	5	21	5	39	5	58	6	21	6	49	7	29	5	39	5	54	6	40	6	37
	11	6	21	6	38	6	57	7	19	7	46	8	24	6	38	6	53	7	38	7	35
	12	7	20	7	36	7	53	8	12	8	37	9	10	7	33	7	51	8	32	8	31
	13	8	18	8	31	8	45	9	01	9	20	9	47	8	25	8	45	9	21	9	24
	14	9	14	9	23	9	33	9	44	9	58	10	17	9	12	9	36	10	05	10	12
	15	10	07	10	12	10	17	10	24	10	32	10	42	9	55	10	23	10	45	10	57
	16	10	57	10	59	11	00	11	01	11	03	11	05	10	36	11	08	11	23	11	39
	17	11	47	11	44	11	41	11	37	11	33	11	27	11	16	11	53	12	00	12	21
	18	12	37	12	30	12	22	12	14	12	03	11	49	11	56	12	37	12	37	13	03
	19	13	28	13	17	13	06	12	52	12	36	12	14	12	38	13	23	13	17	13	46
	20	14	20	14	06	13	51	13	34	13	13	12	44	13	23	14	11	13	59	14	32
	21	15	13	14	57	14	40	14	19	13	54	13	19	14	11	15	02	14	45	15	21
	22	16	08	15	50	15	31	15	09	14	42	14	02	15	02	15	54	15	35	16	13
	23	17	02	16	44	16	25	16	02	15	34	14	54	15	55	16	48	16	28	17	07
	24	17	55	17	38	17	19	16	58	16	32	15	54	16	50	17	42	17	24	18	01
	25	18	45	18	30	18	14	17	55	17	31	16	58	17	45	18	35	18	20	18	55
	26	19	33	19	20	19	07	18	51	18	32	18	05	18	39	19	26	19	16	19	48
	27	20	18	20	09	19	58	19	47	19	32	19	12	19	31	20	15	20	11	20	39
	28	21	01	20	55	20	48	20	40	20	31	20	18	20	22	21	02	21	04	21	28
	29	21	42	21	39	21	36	21	33	21	29	21	23	21	11	21	48	21	56	22	16
	30	22	23	22	24	22	24	22	25	22	26	22	27	22	00	22	33	22	47	23	04
	31	23	04	23	08	23	12	23	17	23	23	23	32	22	49	23	19	23	39	23	52
Feb.	1	23	46	23	53	**	**	**	**	**	**	**	**	23	39	**	**	**	**	**	**
	2	**	**	**	**	0	01	0	11	0	22	0	38	**	**	0	05	0	32	0	40
	3	0	30	0	41	0	52	1	06	1	22	1	45	0	31	0	54	1	26	1	31
	4	1	17	1	31	1	46	2	03	2	24	2	54	1	26	1	45	2	23	2	25
	5	2	09	2	25	2	42	3	02	3	27	4	03	2	22	2	39	3	21	3	20
	6	3	04	3	21	3	40	4	02	4	30	5	09	3	21	3	36	4	21	4	18
	7	4	02	4	20	4	39	5	01	5	29	6	09	4	20	4	35	5	20	5	17
	8	5	02	5	19	5	37	5	57	6	23	7	00	5	17	5	34	6	17	6	15
	9	6	02	6	16	6	32	6	49	7	11	7	41	6	12	6	30	7	09	7	10
	10	7	00	7	11	7	23	7	36	7	53	8	15	7	02	7	24	7	56	8	01
	11	7	56	8	03	8	10	8	19	8	29	8	43	7	48	8	15	8	40	8	49
	12	8	49	8	52	8	55	8	58	9	02	9	07	8	32	9	03	9	20	9	34
	13	9	41	9	40	9	38	9	36	9	34	9	30	9	14	9	49	9	58	10	18
	14	10	33	10	27	10	21	10	14	10	05	9	53	9	55	10	35	10	37	11	01
	15	11	24	11	15	11	04	10	52	10	38	10	18	10	37	11	21	11	16	11	45

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE, 2020
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Feb.	15	23	52	**	**	**	**	**	**	**	**	**	**	23	55	**	**	**	**	**	**
	16	**	**	0	03	0	16	0	30	0	48	1	13	**	**	0	17	0	50	0	55
	17	0	44	0	59	1	15	1	33	1	56	2	28	0	55	1	13	1	53	1	53
	18	1	38	1	55	2	13	2	34	3	00	3	38	1	53	2	10	2	53	2	51
	19	2	32	2	50	3	09	3	31	3	59	4	40	2	50	3	05	3	50	3	47
	20	3	25	3	43	4	02	4	24	4	52	5	32	3	43	3	58	4	43	4	40
	21	4	16	4	33	4	51	5	12	5	38	6	14	4	32	4	48	5	31	5	29
	22	5	06	5	21	5	36	5	54	6	17	6	48	5	17	5	35	6	14	6	15
	23	5	53	6	05	6	18	6	32	6	51	7	15	5	57	6	18	6	52	6	56
	24	6	37	6	46	6	56	7	07	7	20	7	38	6	34	6	59	7	27	7	34
	25	7	20	7	25	7	31	7	38	7	47	7	58	7	09	7	37	7	59	8	10
	26	8	01	8	03	8	05	8	08	8	11	8	16	7	42	8	13	8	30	8	45
	27	8	41	8	40	8	39	8	37	8	36	8	33	8	15	8	49	9	00	9	18
	28	9	22	9	17	9	12	9	07	9	00	8	51	8	47	9	26	9	30	9	52
	29	10	04	9	56	9	47	9	38	9	26	9	10	9	21	10	03	10	01	10	28
Mar.	1	10	48	10	37	10	25	10	11	9	55	9	32	9	58	10	43	10	35	11	06
	2	11	35	11	21	11	06	10	49	10	27	9	58	10	38	11	26	11	13	11	47
	3	12	25	12	08	11	51	11	31	11	06	10	31	11	22	12	13	11	56	12	32
	4	13	18	13	01	12	42	12	20	11	52	11	13	12	12	13	05	12	45	13	23
	5	14	15	13	57	13	37	13	15	12	47	12	06	13	08	14	01	13	41	14	19
	6	15	14	14	56	14	38	14	17	13	50	13	12	14	09	15	01	14	43	15	20
	7	16	13	15	58	15	42	15	24	15	01	14	29	15	13	16	03	15	49	16	24
	8	17	11	16	59	16	47	16	33	16	16	15	52	16	19	17	05	16	58	17	29
	9	18	07	18	00	17	52	17	43	17	32	17	17	17	26	18	07	18	07	18	33
	10	19	02	18	59	18	57	18	53	18	49	18	44	18	31	19	08	19	16	19	37
	11	19	56	19	58	20	00	20	02	20	05	20	09	19	36	20	08	20	24	20	40
	12	20	49	20	56	21	03	21	10	21	20	21	34	20	40	21	07	21	32	21	42
	13	21	43	21	54	22	05	22	18	22	34	22	56	21	43	22	06	22	38	22	44
	14	22	37	22	51	23	06	23	23	23	45	**	**	22	46	23	05	23	43	23	45
	15	23	32	23	49	**	**	**	**	**	**	0	16	23	47	**	**	**	**	**	**
	16	**	**	**	**	0	07	0	27	0	53	1	30	**	**	0	04	0	46	0	45
	17	0	27	0	45	1	04	1	27	1	55	2	35	0	46	1	00	1	46	1	43
	18	1	21	1	40	1	59	2	22	2	50	3	31	1	40	1	55	2	41	2	37
	19	2	14	2	31	2	50	3	11	3	38	4	16	2	31	2	46	3	30	3	28
	20	3	04	3	19	3	36	3	55	4	19	4	52	3	16	3	34	4	14	4	14
	21	3	51	4	04	4	18	4	34	4	53	5	21	3	58	4	18	4	53	4	56
	22	4	36	4	46	4	56	5	09	5	24	5	44	4	35	4	58	5	29	5	35
	23	5	18	5	25	5	32	5	41	5	51	6	04	5	10	5	37	6	01	6	11
	24	6	00	6	03	6	07	6	11	6	16	6	22	5	44	6	14	6	32	6	46
	25	6	40	6	40	6	40	6	40	6	40	6	40	6	16	6	50	7	02	7	19
	26	7	21	7	17	7	13	7	09	7	04	6	57	6	48	7	26	7	32	7	53
	27	8	02	7	55	7	48	7	39	7	29	7	15	7	22	8	03	8	03	8	28
	28	8	45	8	35	8	24	8	12	7	56	7	35	7	57	8	41	8	36	9	05
	29	9	31	9	18	9	03	8	47	8	27	7	59	8	35	9	23	9	12	9	44
	30	10	19	10	03	9	46	9	27	9	03	8	29	9	18	10	08	9	52	10	28
	31	11	10	10	53	10	34	10	12	9	45	9	06	10	05	10	57	10	38	11	16
Apr.	1	12	04	11	46	11	26	11	04	10	35	9	54	10	57	11	50	11	29	12	08

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2020
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Feb.	15	11	24	11	15	11	04	10	52	10	38	10	18	10	37	11	21	11	16	11	45
	16	12	17	12	03	11	49	11	33	11	13	10	46	11	21	12	09	11	58	12	30
	17	13	10	12	54	12	37	12	18	11	53	11	19	12	08	12	59	12	43	13	18
	18	14	04	13	46	13	27	13	06	12	39	12	00	12	58	13	50	13	31	14	09
	19	14	57	14	39	14	20	13	57	13	29	12	49	13	50	14	43	14	23	15	02
	20	15	50	15	32	15	14	14	52	14	24	13	45	14	44	15	37	15	18	15	55
	21	16	41	16	25	16	08	15	48	15	23	14	48	15	39	16	29	16	13	16	49
	22	17	29	17	15	17	01	16	44	16	23	15	53	16	33	17	21	17	09	17	42
	23	18	14	18	04	17	52	17	39	17	23	17	00	17	25	18	10	18	04	18	33
	24	18	58	18	50	18	42	18	33	18	22	18	06	18	16	18	58	18	57	19	23
	25	19	40	19	36	19	31	19	26	19	20	19	12	19	06	19	44	19	49	20	11
	26	20	20	20	20	20	19	20	19	20	18	20	17	19	55	20	29	20	41	20	59
	27	21	01	21	04	21	07	21	11	21	15	21	21	20	44	21	14	21	32	21	47
	28	21	42	21	49	21	55	22	03	22	13	22	26	21	33	22	00	22	24	22	35
	29	22	25	22	35	22	45	22	57	23	12	23	32	22	24	22	47	23	17	23	24
Mar.	1	23	10	23	23	23	37	23	52	**	**	**	**	23	16	23	36	**	**	**	**
	2	23	58	**	**	**	**	**	**	0	12	0	39	**	**	**	**	0	12	0	15
	3	**	**	0	14	0	30	0	49	1	13	1	47	0	11	0	28	1	09	1	09
	4	0	50	1	07	1	26	1	47	2	14	2	53	1	07	1	22	2	06	2	04
	5	1	45	2	03	2	23	2	45	3	14	3	54	2	04	2	19	3	04	3	01
	6	2	43	3	01	3	20	3	42	4	09	4	48	3	01	3	16	4	01	3	58
	7	3	42	3	58	4	15	4	35	4	59	5	33	3	55	4	12	4	54	4	53
	8	4	40	4	53	5	07	5	23	5	43	6	10	4	47	5	07	5	43	5	46
	9	5	38	5	47	5	57	6	08	6	22	6	40	5	35	5	59	6	29	6	36
	10	6	33	6	38	6	44	6	49	6	57	7	06	6	21	6	49	7	11	7	23
	11	7	28	7	28	7	28	7	29	7	29	7	30	7	05	7	38	7	51	8	08
	12	8	21	8	17	8	13	8	08	8	02	7	53	7	48	8	25	8	31	8	53
	13	9	15	9	06	8	57	8	47	8	35	8	18	8	31	9	13	9	11	9	38
	14	10	09	9	57	9	44	9	29	9	11	8	46	9	16	10	03	9	53	10	25
	15	11	04	10	48	10	32	10	13	9	50	9	18	10	03	10	53	10	39	11	13
	16	11	59	11	41	11	23	11	01	10	35	9	57	10	54	11	46	11	27	12	04
	17	12	53	12	35	12	16	11	53	11	24	10	44	11	46	12	39	12	19	12	57
	18	13	47	13	29	13	09	12	47	12	19	11	39	12	40	13	33	13	13	13	51
	19	14	38	14	21	14	04	13	43	13	17	12	40	13	34	14	26	14	08	14	45
	20	15	27	15	12	14	57	14	39	14	16	13	45	14	28	15	17	15	04	15	38
	21	16	13	16	01	15	49	15	34	15	16	14	51	15	21	16	07	15	59	16	30
	22	16	56	16	48	16	39	16	28	16	15	15	57	16	12	16	55	16	52	17	20
	23	17	38	17	33	17	28	17	21	17	14	17	03	17	02	17	41	17	45	18	08
	24	18	19	18	18	18	16	18	14	18	11	18	08	17	51	18	27	18	36	18	56
	25	19	00	19	02	19	04	19	06	19	09	19	13	18	40	19	12	19	28	19	43
	26	19	41	19	46	19	52	19	59	20	07	20	18	19	29	19	57	20	20	20	31
	27	20	23	20	32	20	41	20	52	21	05	21	24	20	20	20	44	21	13	21	20
	28	21	07	21	19	21	32	21	47	22	05	22	30	21	11	21	32	22	07	22	11
	29	21	54	22	09	22	24	22	43	23	05	23	38	22	04	22	23	23	02	23	03
	30	22	43	23	00	23	18	23	39	**	**	**	**	22	59	23	15	23	59	23	57
	31	23	36	23	54	**	**	**	**	0	06	0	43	23	55	**	**	**	**	**	**
Apr.	1	**	**	**	**	0	14	0	36	1	05	1	45	**	**	0	09	0	55	0	52

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE, 2020
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Apr.	1	12	04	11	46	11	26	11	04	10	35	9	54	10	57	11	50	11	29	12	08
	2	13	00	12	42	12	23	12	01	11	33	10	53	11	54	12	47	12	27	13	05
	3	13	57	13	41	13	24	13	04	12	38	12	03	12	55	13	46	13	29	14	05
	4	14	54	14	41	14	26	14	10	13	49	13	21	13	58	14	46	14	35	15	08
	5	15	50	15	40	15	30	15	18	15	04	14	44	15	03	15	47	15	43	16	11
	6	16	44	16	39	16	34	16	27	16	19	16	09	16	08	16	47	16	51	17	14
	7	17	39	17	38	17	37	17	37	17	36	17	35	17	13	17	47	17	59	18	18
	8	18	33	18	37	18	41	18	46	18	53	19	01	18	18	18	48	19	08	19	21
	9	19	27	19	36	19	45	19	56	20	09	20	27	19	23	19	48	20	17	20	25
	10	20	23	20	36	20	49	21	05	21	24	21	52	20	29	20	49	21	25	21	28
	11	21	20	21	36	21	53	22	12	22	37	23	12	21	33	21	50	22	32	22	31
	12	22	17	22	35	22	54	23	16	23	44	**	**	22	35	22	50	23	35	23	33
	13	23	14	23	32	23	52	**	**	**	**	0	24	23	33	23	48	**	**	**	**
	14	**	**	**	**	**	**	0	15	0	44	1	26	**	**	**	**	0	34	0	30
	15	0	08	0	26	0	46	1	08	1	36	2	16	0	27	0	42	1	27	1	24
	16	1	00	1	17	1	34	1	54	2	20	2	55	1	15	1	31	2	13	2	12
	17	1	49	2	03	2	18	2	35	2	56	3	26	1	58	2	17	2	55	2	56
	18	2	34	2	46	2	57	3	11	3	28	3	51	2	37	2	59	3	31	3	36
	19	3	18	3	26	3	34	3	44	3	56	4	12	3	12	3	38	4	04	4	13
	20	3	59	4	04	4	08	4	14	4	21	4	30	3	46	4	15	4	35	4	47
	21	4	40	4	41	4	42	4	43	4	45	4	47	4	18	4	51	5	05	5	21
	22	5	20	5	18	5	15	5	12	5	08	5	04	4	50	5	26	5	34	5	55
	23	6	01	5	55	5	49	5	42	5	33	5	21	5	23	6	03	6	05	6	29
	24	6	44	6	35	6	25	6	13	5	59	5	41	5	58	6	41	6	37	7	05
	25	7	29	7	16	7	03	6	48	6	29	6	03	6	35	7	22	7	12	7	44
	26	8	16	8	01	7	45	7	26	7	03	6	31	7	16	8	06	7	51	8	26
	27	9	07	8	49	8	31	8	09	7	43	7	05	8	02	8	54	8	35	9	12
	28	10	00	9	41	9	21	8	58	8	30	7	49	8	52	9	45	9	24	10	03
	29	10	54	10	36	10	16	9	53	9	24	8	43	9	46	10	40	10	19	10	58
	30	11	49	11	32	11	14	10	53	10	26	9	48	10	45	11	37	11	18	11	56
May	1	12	44	12	30	12	14	11	56	11	33	11	01	11	45	12	35	12	21	12	56
	2	13	39	13	27	13	15	13	01	12	44	12	20	12	47	13	33	13	26	13	56
	3	14	32	14	24	14	16	14	07	13	56	13	41	13	50	14	32	14	31	14	57
	4	15	24	15	21	15	18	15	14	15	10	15	04	14	53	15	30	15	38	15	59
	5	16	17	16	18	16	20	16	22	16	25	16	28	15	56	16	29	16	44	17	00
	6	17	10	17	16	17	23	17	31	17	40	17	54	17	01	17	28	17	52	18	03
	7	18	05	18	16	18	27	18	40	18	57	19	19	18	06	18	29	19	01	19	06
	8	19	02	19	17	19	32	19	50	20	12	20	44	19	12	19	31	20	10	20	11
	9	20	01	20	18	20	36	20	58	21	24	22	03	20	17	20	33	21	17	21	15
	10	21	00	21	18	21	38	22	01	22	30	23	12	21	19	21	34	22	20	22	16
	11	21	57	22	16	22	36	22	59	23	28	**	**	22	17	22	31	23	18	23	14
	12	22	52	23	09	23	28	23	49	**	**	0	10	23	09	23	24	**	**	**	**
	13	23	43	23	58	**	**	**	**	0	16	0	54	23	55	**	**	0	08	0	06
	14	**	**	**	**	0	15	0	33	0	57	1	29	**	**	0	13	0	53	0	53
	15	0	31	0	43	0	56	1	12	1	30	1	56	0	36	0	57	1	31	1	35
	16	1	15	1	24	1	34	1	46	1	59	2	18	1	13	1	37	2	06	2	13
	17	1	57	2	03	2	10	2	17	2	25	2	37	1	47	2	15	2	38	2	48

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2020
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.														FOR CERTAIN STATIONS IN INDIA IN I.S.T							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Apr.	1	**	**	**	**	0	14	0	36	1	05	1	45	**	**	0	09	0	55	0	52
	2	0	31	0	49	1	09	1	32	2	00	2	41	0	50	1	05	1	50	1	47
	3	1	28	1	45	2	03	2	24	2	50	3	27	1	44	2	00	2	43	2	41
	4	2	24	2	39	2	55	3	13	3	35	4	06	2	35	2	53	3	32	3	33
	5	3	21	3	32	3	44	3	58	4	15	4	38	3	23	3	45	4	18	4	23
	6	4	16	4	23	4	31	4	40	4	50	5	05	4	09	4	35	5	01	5	10
	7	5	10	5	13	5	16	5	19	5	24	5	29	4	53	5	23	5	41	5	55
	8	6	04	6	02	6	00	5	58	5	56	5	52	5	36	6	11	6	21	6	40
	9	6	58	6	52	6	45	6	38	6	29	6	16	6	20	7	00	7	01	7	26
	10	7	54	7	43	7	32	7	19	7	04	6	42	7	05	7	50	7	43	8	13
	11	8	50	8	36	8	21	8	04	7	42	7	13	7	53	8	41	8	29	9	02
	12	9	48	9	31	9	13	8	52	8	26	7	50	8	44	9	35	9	18	9	54
	13	10	45	10	26	10	07	9	44	9	16	8	35	9	37	10	30	10	10	10	49
	14	11	40	11	22	11	02	10	39	10	10	9	29	10	32	11	26	11	05	11	44
	15	12	34	12	16	11	57	11	36	11	08	10	29	11	28	12	20	12	02	12	39
	16	13	24	13	08	12	52	12	33	12	09	11	35	12	23	13	13	12	58	13	33
	17	14	11	13	58	13	45	13	29	13	09	12	41	13	17	14	04	13	54	14	26
	18	14	55	14	46	14	35	14	23	14	09	13	48	14	08	14	52	14	48	15	16
	19	15	38	15	31	15	25	15	17	15	07	14	54	14	59	15	39	15	40	16	05
	20	16	19	16	16	16	13	16	09	16	05	15	59	15	48	16	25	16	32	16	53
	21	16	59	17	00	17	01	17	01	17	03	17	04	16	37	17	10	17	24	17	40
	22	17	40	17	44	17	49	17	54	18	00	18	09	17	26	17	55	18	15	18	28
	23	18	22	18	29	18	38	18	47	18	59	19	15	18	16	18	41	19	08	19	17
	24	19	05	19	16	19	28	19	42	19	59	20	22	19	07	19	29	20	02	20	07
	25	19	51	20	06	20	21	20	38	21	00	21	30	20	01	20	19	20	58	20	59
	26	20	40	20	57	21	14	21	35	22	01	22	37	20	55	21	12	21	54	21	53
	27	21	32	21	50	22	09	22	32	23	00	23	41	21	50	22	05	22	51	22	48
	28	22	26	22	44	23	04	23	27	23	56	**	**	22	45	23	00	23	46	23	42
	29	23	21	23	39	23	58	**	**	**	**	0	38	23	39	23	54	**	**	**	**
	30	**	**	**	**	**	**	0	20	0	47	1	26	**	**	**	**	0	39	0	36
May	1	0	16	0	32	0	49	1	08	1	33	2	07	0	29	0	46	1	28	1	27
	2	1	10	1	23	1	37	1	53	2	13	2	39	1	17	1	37	2	13	2	16
	3	2	04	2	13	2	23	2	34	2	48	3	07	2	02	2	26	2	55	3	02
	4	2	57	3	02	3	07	3	13	3	21	3	31	2	45	3	13	3	34	3	46
	5	3	49	3	50	3	50	3	51	3	52	3	53	3	26	3	59	4	13	4	30
	6	4	42	4	38	4	34	4	29	4	23	4	15	4	09	4	46	4	52	5	14
	7	5	36	5	28	5	19	5	09	4	56	4	40	4	52	5	35	5	32	5	59
	8	6	32	6	20	6	07	5	51	5	33	5	07	5	39	6	26	6	16	6	48
	9	7	30	7	14	6	58	6	38	6	14	5	41	6	29	7	19	7	04	7	39
	10	8	29	8	11	7	52	7	30	7	02	6	23	7	23	8	15	7	56	8	34
	11	9	28	9	09	8	49	8	25	7	56	7	14	8	19	9	13	8	51	9	31
	12	10	24	10	06	9	46	9	23	8	55	8	14	9	16	10	10	9	49	10	28
	13	11	17	11	00	10	43	10	22	9	56	9	19	10	14	11	05	10	48	11	24
	14	12	06	11	52	11	37	11	20	10	58	10	28	11	09	11	58	11	45	12	19
	15	12	52	12	41	12	30	12	16	11	59	11	36	12	02	12	48	12	41	13	11
	16	13	36	13	28	13	20	13	10	12	59	12	43	12	53	13	35	13	34	14	00
	17	14	17	14	13	14	09	14	03	13	57	13	48	13	43	14	21	14	27	14	49

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE, 2020
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.														FOR CERTAIN STATIONS IN INDIA IN I.S.T							
Date \ Lat.		0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
May	17	1	57	2	03	2	10	2	17	2	25	2	37	1	47	2	15	2	38	2	48
	18	2	38	2	41	2	43	2	46	2	49	2	54	2	20	2	51	3	08	3	22
	19	3	19	3	17	3	16	3	15	3	13	3	11	2	52	3	27	3	37	3	56
	20	3	59	3	55	3	50	3	44	3	37	3	28	3	24	4	03	4	07	4	30
	21	4	42	4	33	4	25	4	15	4	03	3	46	3	58	4	40	4	38	5	05
	22	5	26	5	14	5	02	4	48	4	31	4	07	4	35	5	20	5	12	5	43
	23	6	13	5	58	5	43	5	25	5	03	4	33	5	15	6	03	5	50	6	24
	24	7	03	6	46	6	28	6	07	5	42	5	05	5	59	6	50	6	33	7	09
	25	7	56	7	37	7	18	6	55	6	27	5	46	6	48	7	41	7	21	7	59
	26	8	50	8	32	8	11	7	48	7	19	6	37	7	42	8	35	8	14	8	53
	27	9	46	9	28	9	09	8	47	8	19	7	39	8	39	9	32	9	13	9	51
	28	10	40	10	25	10	08	9	49	9	24	8	50	9	39	10	30	10	14	10	50
	29	11	34	11	21	11	08	10	52	10	33	10	06	10	40	11	27	11	17	11	49
	30	12	26	12	17	12	08	11	57	11	43	11	25	11	41	12	24	12	21	12	49
	31	13	17	13	12	13	07	13	01	12	54	12	45	12	41	13	20	13	25	13	48
June	1	14	07	14	07	14	07	14	06	14	06	14	06	13	42	14	17	14	29	14	47
	2	14	59	15	03	15	07	15	12	15	19	15	28	14	44	15	14	15	34	15	47
	3	15	51	16	00	16	09	16	19	16	33	16	51	15	47	16	12	16	40	16	48
	4	16	46	16	59	17	12	17	28	17	47	18	14	16	52	17	12	17	48	17	51
	5	17	44	17	59	18	16	18	36	19	01	19	36	17	57	18	14	18	56	18	55
	6	18	42	19	00	19	20	19	42	20	11	20	51	19	01	19	16	20	01	19	58
	7	19	41	20	00	20	20	20	44	21	13	21	56	20	02	20	16	21	03	20	59
	8	20	39	20	57	21	16	21	39	22	07	22	48	20	58	21	12	21	58	21	55
	9	21	33	21	49	22	07	22	27	22	52	23	27	21	47	22	04	22	46	22	45
	10	22	23	22	37	22	52	23	08	23	29	23	58	22	32	22	51	23	28	23	30
	11	23	10	23	20	23	32	23	45	**	**	**	**	23	11	23	33	**	**	**	**
	12	23	53	**	**	**	**	**	**	0	01	0	23	23	47	**	**	0	05	0	10
	13	**	**	0	01	0	09	0	17	0	28	0	43	**	**	0	13	0	38	0	47
	14	0	35	0	39	0	43	0	47	0	53	1	01	0	20	0	50	1	09	1	22
	15	1	16	1	16	1	16	1	16	1	17	1	17	0	52	1	25	1	38	1	55
	16	1	56	1	53	1	49	1	45	1	40	1	34	1	24	2	01	2	08	2	29
	17	2	38	2	31	2	23	2	15	2	05	1	51	1	57	2	38	2	38	3	04
	18	3	21	3	11	3	00	2	47	2	32	2	11	2	33	3	17	3	11	3	40
	19	4	07	3	53	3	39	3	23	3	03	2	35	3	11	3	59	3	48	4	20
	20	4	56	4	40	4	23	4	03	3	39	3	05	3	54	4	45	4	29	5	04
	21	5	48	5	31	5	11	4	49	4	22	3	42	4	42	5	35	5	15	5	53
	22	6	43	6	25	6	05	5	42	5	12	4	30	5	35	6	29	6	07	6	47
	23	7	40	7	22	7	02	6	39	6	11	5	30	6	32	7	26	7	05	7	44
	24	8	36	8	19	8	02	7	41	7	16	6	39	7	33	8	24	8	07	8	44
	25	9	31	9	17	9	02	8	45	8	24	7	55	8	34	9	22	9	11	9	44
	26	10	23	10	13	10	02	9	50	9	35	9	13	9	35	10	20	10	14	10	44
	27	11	14	11	08	11	02	10	54	10	45	10	33	10	36	11	16	11	18	11	42
	28	12	04	12	02	12	00	11	58	11	56	11	52	11	36	12	11	12	21	12	41
	29	12	54	12	56	12	59	13	02	13	06	13	12	12	36	13	07	13	24	13	39
	30	13	44	13	51	13	59	14	07	14	18	14	33	13	36	14	03	14	28	14	38
July	1	14	37	14	48	14	59	15	13	15	30	15	54	14	38	15	01	15	33	15	38
	2	15	31	15	46	16	02	16	20	16	42	17	14	15	41	16	00	16	39	16	40

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2020

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF MOONSET (MOON'S UPPER LIMB)

Date		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T							
	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
May	17	14	17	14	13	14	09	14	03	13	57	13	48	13	43	14	21	14	27	14	49
	18	14	58	14	57	14	56	14	56	14	55	14	53	14	32	15	06	15	18	15	36
	19	15	38	15	41	15	44	15	48	15	52	15	59	15	21	15	52	16	10	16	24
	20	16	20	16	26	16	33	16	41	16	51	17	04	16	11	16	38	17	02	17	12
	21	17	03	17	13	17	23	17	36	17	51	18	12	17	02	17	25	17	56	18	02
	22	17	48	18	01	18	15	18	32	18	52	19	20	17	55	18	15	18	51	18	54
	23	18	37	18	52	19	09	19	29	19	54	20	28	18	50	19	07	19	48	19	48
	24	19	28	19	46	20	05	20	27	20	55	21	34	19	46	20	01	20	46	20	43
	25	20	22	20	40	21	00	21	23	21	53	22	35	20	42	20	56	21	42	21	38
	26	21	17	21	35	21	55	22	17	22	46	23	26	21	36	21	50	22	36	22	33
	27	22	12	22	29	22	47	23	07	23	33	**	**	22	27	22	44	23	26	23	25
	28	23	06	23	20	23	35	23	53	**	**	0	09	23	15	23	34	**	**	**	**
	29	23	59	**	**	**	**	**	**	0	14	0	43	**	**	**	**	0	12	0	14
	30	**	**	0	10	0	21	0	34	0	50	1	12	0	00	0	23	0	54	1	00
	31	0	50	0	57	1	04	1	12	1	22	1	36	0	42	1	09	1	33	1	43
June	1	1	41	1	43	1	46	1	49	1	53	1	57	1	23	1	54	2	11	2	25
	2	2	32	2	30	2	28	2	25	2	22	2	18	2	03	2	39	2	48	3	07
	3	3	23	3	17	3	10	3	03	2	53	2	41	2	44	3	25	3	26	3	51
	4	4	17	4	06	3	55	3	43	3	27	3	06	3	28	4	13	4	07	4	36
	5	5	13	4	59	4	44	4	27	4	05	3	35	4	16	5	04	4	51	5	25
	6	6	12	5	54	5	36	5	15	4	49	4	12	5	07	5	59	5	41	6	18
	7	7	11	6	52	6	32	6	09	5	40	4	59	6	03	6	56	6	35	7	14
	8	8	09	7	51	7	30	7	07	6	38	5	55	7	01	7	54	7	33	8	12
	9	9	05	8	48	8	29	8	07	7	40	7	00	7	59	8	52	8	33	9	11
	10	9	57	9	42	9	26	9	07	8	43	8	09	8	57	9	47	9	32	10	07
	11	10	46	10	34	10	20	10	05	9	46	9	19	9	52	10	39	10	30	11	02
	12	11	31	11	22	11	12	11	01	10	47	10	28	10	45	11	29	11	25	11	53
	13	12	14	12	08	12	02	11	55	11	47	11	35	11	36	12	16	12	19	12	42
	14	12	55	12	53	12	50	12	48	12	45	12	41	12	26	13	02	13	11	13	30
	15	13	35	13	37	13	38	13	40	13	43	13	46	13	15	13	47	14	02	14	18
	16	14	16	14	21	14	27	14	33	14	41	14	51	14	04	14	32	14	54	15	06
	17	14	58	15	07	15	16	15	27	15	40	15	58	14	54	15	19	15	47	15	55
	18	15	43	15	55	16	07	16	22	16	40	17	06	15	47	16	08	16	42	16	46
	19	16	30	16	45	17	01	17	19	17	42	18	15	16	41	16	59	17	39	17	39
	20	17	21	17	38	17	56	18	18	18	45	19	23	17	37	17	53	18	37	18	35
	21	18	15	18	33	18	53	19	16	19	45	20	26	18	34	18	49	19	35	19	31
	22	19	10	19	29	19	49	20	12	20	41	21	22	19	30	19	44	20	31	20	27
	23	20	07	20	24	20	43	21	04	21	31	22	09	20	24	20	39	21	23	21	21
	24	21	02	21	17	21	33	21	52	22	15	22	46	21	14	21	32	22	11	22	12
	25	21	56	22	08	22	20	22	35	22	52	23	16	22	00	22	21	22	55	22	59
	26	22	48	22	56	23	04	23	14	23	26	23	42	22	43	23	08	23	35	23	43
	27	23	38	23	42	23	46	23	51	23	56	**	**	23	23	23	53	**	**	**	**
	28	**	**	**	**	**	**	**	**	**	**	0	04	**	**	**	**	0	12	0	25
	29	0	28	0	27	0	27	0	26	0	25	0	24	0	02	0	37	0	48	1	06
	30	1	17	1	13	1	08	1	02	0	55	0	45	0	42	1	21	1	25	1	48
July	1	2	09	2	00	1	50	1	39	1	26	1	08	1	24	2	07	2	03	2	31
	2	3	02	2	50	2	36	2	20	2	01	1	35	2	08	2	55	2	45	3	17

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE, 2020
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

Date \ Lat.		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T							
		0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
July	1	14	37	14	48	14	59	15	13	15	30	15	54	14	38	15	01	15	33	15	38
	2	15	31	15	46	16	02	16	20	16	42	17	14	15	41	16	00	16	39	16	40
	3	16	28	16	46	17	04	17	25	17	52	18	31	16	45	17	01	17	45	17	42
	4	17	27	17	45	18	05	18	28	18	58	19	40	17	46	18	01	18	47	18	44
	5	18	25	18	43	19	03	19	26	19	55	20	37	18	45	18	59	19	45	19	41
	6	19	20	19	38	19	56	20	18	20	45	21	22	19	37	19	53	20	37	20	35
	7	20	13	20	28	20	44	21	03	21	25	21	57	20	24	20	42	21	22	21	22
	8	21	02	21	14	21	27	21	42	22	00	22	25	21	06	21	27	22	01	22	05
	9	21	47	21	56	22	05	22	16	22	29	22	47	21	44	22	08	22	36	22	44
	10	22	30	22	35	22	41	22	47	22	55	23	05	22	19	22	47	23	08	23	20
	11	23	11	23	13	23	15	23	17	23	19	23	23	22	51	23	23	23	38	23	54
	12	23	52	23	50	23	48	23	46	23	43	23	39	23	23	23	59	**	**	**	**
	13	**	**	**	**	**	**	**	**	**	**	23	56	23	56	**	**	0	08	0	27
	14	0	33	0	27	0	21	0	15	0	07	**	**	**	**	0	35	0	38	1	01
	15	1	15	1	06	0	56	0	46	0	33	0	15	0	30	1	13	1	09	1	37
	16	1	59	1	47	1	34	1	20	1	01	0	37	1	07	1	53	1	44	2	15
	17	2	47	2	32	2	16	1	58	1	35	1	03	1	48	2	37	2	23	2	57
	18	3	38	3	21	3	02	2	41	2	15	1	37	2	33	3	25	3	07	3	44
	19	4	32	4	14	3	54	3	31	3	02	2	21	3	24	4	18	3	57	4	36
	20	5	29	5	10	4	50	4	27	3	58	3	16	4	21	5	14	4	53	5	32
	21	6	26	6	09	5	50	5	29	5	02	4	23	5	21	6	13	5	55	6	32
	22	7	23	7	08	6	52	6	34	6	11	5	39	6	24	7	13	6	59	7	34
	23	8	18	8	06	7	54	7	40	7	23	6	59	7	27	8	13	8	05	8	36
	24	9	10	9	03	8	55	8	46	8	35	8	20	8	29	9	10	9	10	9	36
	25	10	01	9	58	9	55	9	51	9	47	9	41	9	30	10	07	10	14	10	35
	26	10	51	10	53	10	54	10	56	10	58	11	01	10	30	11	03	11	18	11	34
	27	11	41	11	47	11	53	12	00	12	09	12	21	11	31	11	59	12	22	12	33
	28	12	33	12	42	12	53	13	05	13	20	13	41	12	32	12	55	13	26	13	32
	29	13	26	13	39	13	54	14	10	14	31	15	01	13	33	13	53	14	30	14	32
	30	14	21	14	37	14	55	15	15	15	41	16	18	14	35	14	52	15	34	15	33
	31	15	17	15	36	15	55	16	18	16	47	17	28	15	36	15	51	16	37	16	33
Aug.	1	16	14	16	33	16	53	17	17	17	46	18	29	16	35	16	49	17	35	17	31
	2	17	10	17	28	17	48	18	10	18	38	19	18	17	29	17	44	18	29	18	26
	3	18	04	18	20	18	37	18	57	19	21	19	56	18	18	18	34	19	16	19	15
	4	18	54	19	07	19	21	19	38	19	58	20	26	19	01	19	21	19	57	20	00
	5	19	41	19	51	20	2	20	14	20	29	20	50	19	41	20	04	20	34	20	40
	6	20	25	20	31	20	38	20	47	20	56	21	9	20	17	20	43	21	07	21	17
	7	21	07	21	10	21	13	21	17	21	21	21	27	20	50	21	20	21	38	21	52
	8	21	48	21	47	21	46	21	46	21	45	21	44	21	22	21	56	22	08	22	26
	9	22	28	22	24	22	20	22	15	22	08	22	00	21	54	22	32	22	37	22	59
	10	23	09	23	02	22	54	22	44	22	33	22	18	22	28	23	09	23	08	23	34
	11	23	52	23	42	23	30	23	17	23	00	22	38	23	03	23	48	23	41	**	**
	12	**	**	**	**	**	**	23	52	23	31	23	02	23	41	**	**	**	**	0	11
	13	0	38	0	24	0	09	**	**	**	**	23	32	**	**	0	29	0	17	0	50
	14	1	27	1	10	0	53	0	33	0	08	**	**	0	24	1	15	0	58	1	34
	15	2	19	2	01	1	41	1	19	0	51	0	11	1	12	2	05	1	45	2	23
	16	3	14	2	56	2	35	2	12	1	43	1	01	2	06	2	59	2	38	3	17

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2020

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

	FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T							
Date \ Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
July 1	2	09	2	00	1	50	1	39	1	26	1	08	1	24	2	07	2	03	2	31
2	3	02	2	50	2	36	2	20	2	01	1	35	2	08	2	55	2	45	3	17
3	3	58	3	42	3	25	3	06	2	42	2	08	2	57	3	47	3	31	4	07
4	4	56	4	38	4	19	3	57	3	29	2	49	3	49	4	42	4	22	5	01
5	5	55	5	36	5	16	4	52	4	23	3	40	4	46	5	40	5	18	5	58
6	6	52	6	34	6	14	5	51	5	23	4	42	5	44	6	38	6	17	6	56
7	7	46	7	30	7	12	6	52	6	26	5	50	6	43	7	34	7	17	7	54
8	8	37	8	23	8	08	7	51	7	30	7	00	7	40	8	29	8	17	8	50
9	9	24	9	14	9	02	8	49	8	33	8	11	8	35	9	20	9	14	9	43
10	10	08	10	01	9	54	9	45	9	34	9	19	9	27	10	09	10	09	10	34
11	10	50	10	47	10	43	10	39	10	33	10	26	10	18	10	55	11	02	11	23
12	11	31	11	31	11	31	11	31	11	31	11	32	11	07	11	41	11	54	12	11
13	12	11	12	15	12	19	12	24	12	29	12	37	11	56	12	26	12	45	12	59
14	12	53	13	00	13	08	13	17	13	28	13	43	12	46	13	12	13	38	13	47
15	13	36	13	47	13	58	14	11	14	27	14	50	13	37	13	59	14	31	14	37
16	14	22	14	36	14	50	15	07	15	28	15	58	14	30	14	49	15	27	15	29
17	15	11	15	27	15	45	16	05	16	30	17	06	15	25	15	42	16	24	16	23
18	16	04	16	22	16	41	17	04	17	32	18	12	16	22	16	37	17	22	17	19
19	16	59	17	18	17	38	18	01	18	30	19	12	17	19	17	33	18	20	18	16
20	17	56	18	14	18	34	18	56	19	24	20	04	18	15	18	30	19	15	19	12
21	18	54	19	10	19	27	19	46	20	11	20	45	19	07	19	24	20	06	20	05
22	19	49	20	02	20	16	20	32	20	52	21	18	19	56	20	16	20	52	20	55
23	20	43	20	52	21	02	21	13	21	27	21	46	20	41	21	05	21	34	21	41
24	21	35	21	40	21	45	21	51	21	59	22	09	21	23	21	51	22	13	22	24
25	22	25	22	26	22	27	22	28	22	29	22	30	22	03	22	36	22	50	23	06
26	23	15	23	11	23	08	23	03	22	58	22	51	22	43	23	20	23	26	23	48
27	**	**	23	58	23	49	23	40	23	29	23	13	23	23	**	**	**	**	**	**
28	0	06	**	**	**	**	**	**	**	**	23	38	**	**	0	05	0	04	0	30
29	0	58	0	46	0	33	0	19	0	02	**	**	0	06	0	52	0	44	1	14
30	1	52	1	37	1	21	1	02	0	39	0	08	0	52	1	42	1	27	2	02
31	2	48	2	30	2	12	1	50	1	23	0	45	1	42	2	34	2	16	2	53
Aug. 1	3	45	3	26	3	06	2	43	2	14	1	32	2	36	3	30	3	09	3	48
2	4	41	4	23	4	03	3	40	3	11	2	28	3	33	4	27	4	06	4	45
3	5	36	5	19	5	01	4	39	4	12	3	33	4	31	5	23	5	05	5	42
4	6	28	6	13	5	57	5	39	5	16	4	43	5	29	6	18	6	04	6	39
5	7	17	7	05	6	52	6	38	6	19	5	54	6	25	7	11	7	02	7	33
6	8	02	7	54	7	45	7	34	7	21	7	04	7	18	8	01	7	58	8	25
7	8	45	8	40	8	35	8	29	8	22	8	11	8	09	8	48	8	52	9	15
8	9	26	9	25	9	24	9	22	9	20	9	18	8	59	9	34	9	45	10	04
9	10	07	10	09	10	12	10	15	10	18	10	23	9	49	10	20	10	37	10	52
10	10	48	10	54	11	00	11	07	11	16	11	29	10	38	11	05	11	29	11	39
11	11	30	11	39	11	49	12	01	12	15	12	35	11	28	11	52	12	21	12	28
12	12	14	12	27	12	40	12	56	13	15	13	42	12	20	12	40	13	16	13	19
13	13	01	13	17	13	33	13	52	14	16	14	50	13	13	13	31	14	11	14	11
14	13	52	14	09	14	28	14	50	15	17	15	56	14	09	14	24	15	09	15	06
15	14	45	15	04	15	24	15	47	16	16	16	58	15	05	15	19	16	06	16	02
16	15	42	16	00	16	20	16	43	17	12	17	53	16	01	16	16	17	02	16	58

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE, 2020
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

	FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T							
Date \ Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Aug. 16	3	14	2	56	2	35	2	12	1	43	1	01	2	06	2	59	2	38	3	17
17	4	12	3	53	3	34	3	12	2	43	2	03	3	04	3	57	3	38	4	16
18	5	09	4	53	4	36	4	16	3	51	3	15	4	07	4	58	4	41	5	18
19	6	06	5	53	5	39	5	23	5	03	4	35	5	11	5	58	5	48	6	20
20	7	01	6	52	6	42	6	31	6	17	5	58	6	15	6	59	6	55	7	23
21	7	54	7	49	7	44	7	38	7	31	7	22	7	18	7	57	8	02	8	25
22	8	45	8	45	8	45	8	45	8	45	8	45	8	21	8	55	9	08	9	26
23	9	37	9	41	9	46	9	52	9	58	10	08	9	23	9	52	10	13	10	26
24	10	29	10	38	10	47	10	58	11	11	11	30	10	25	10	50	11	19	11	26
25	11	22	11	35	11	48	12	04	12	23	12	51	11	27	11	48	12	24	12	27
26	12	17	12	32	12	49	13	09	13	34	14	09	12	30	12	47	13	28	13	28
27	13	12	13	31	13	50	14	12	14	40	15	21	13	31	13	46	14	31	14	28
28	14	09	14	28	14	48	15	12	15	41	16	24	14	29	14	43	15	30	15	26
29	15	04	15	23	15	43	16	06	16	34	17	16	15	24	15	38	16	24	16	21
30	15	58	16	15	16	33	16	54	17	20	17	56	16	14	16	30	17	13	17	11
31	16	49	17	03	17	18	17	36	17	58	18	28	16	59	17	17	17	55	17	57
Sept. 1	17	36	17	47	17	59	18	13	18	30	18	53	17	39	18	00	18	33	18	38
2	18	21	18	29	18	37	18	47	18	58	19	14	18	15	18	41	19	07	19	16
3	19	3	19	8	19	12	19	17	19	24	19	32	18	50	19	18	19	39	19	51
4	19	44	19	45	19	46	19	47	19	48	19	49	19	22	19	55	20	08	20	25
5	20	25	20	22	20	19	20	15	20	11	20	5	19	54	20	31	20	38	20	59
6	21	06	20	59	20	52	20	45	20	35	20	22	20	27	21	07	21	08	21	32
7	21	48	21	38	21	27	21	15	21	01	20	41	21	01	21	44	21	39	22	08
8	22	32	22	19	22	05	21	49	21	30	21	03	21	37	22	24	22	14	22	46
9	23	19	23	03	22	46	22	27	22	03	21	30	22	18	23	08	22	52	23	27
10	**	**	23	51	23	32	23	10	22	42	22	04	23	02	23	55	23	35	**	**
11	0	08	**	**	**	**	23	59	23	29	22	47	23	52	**	**	**	**	0	13
12	1	01	0	42	0	22	**	**	**	**	23	43	**	**	0	46	0	25	1	04
13	1	56	1	38	1	18	0	54	0	25	**	**	0	48	1	41	1	20	2	00
14	2	53	2	36	2	17	1	55	1	28	0	50	1	48	2	40	2	21	2	59
15	3	49	3	35	3	19	3	01	2	38	2	06	2	50	3	40	3	26	4	01
16	4	45	4	34	4	22	4	09	3	52	3	28	3	55	4	40	4	33	5	04
17	5	40	5	33	5	26	5	17	5	07	4	53	4	59	5	40	5	41	6	06
18	6	33	6	31	6	29	6	26	6	23	6	18	6	04	6	40	6	49	7	09
19	7	26	7	29	7	31	7	35	7	39	7	44	7	08	7	39	7	57	8	11
20	8	19	8	27	8	34	8	43	8	54	9	10	8	12	8	39	9	04	9	14
21	9	14	9	25	9	38	9	52	10	10	10	34	9	17	9	39	10	12	10	17
22	10	10	10	25	10	41	11	00	11	23	11	57	10	21	10	39	11	19	11	20
23	11	07	11	25	11	44	12	06	12	33	13	13	11	24	11	40	12	25	12	22
24	12	04	12	23	12	44	13	07	13	37	14	20	12	25	12	39	13	26	13	22
25	13	01	13	20	13	40	14	03	14	33	15	16	13	21	13	35	14	22	14	18
26	13	55	14	12	14	31	14	53	15	20	15	59	14	12	14	28	15	12	15	09
27	14	46	15	01	15	18	15	37	16	00	16	33	14	58	15	16	15	56	15	56
28	15	34	15	46	16	00	16	15	16	33	16	59	15	39	16	00	16	34	16	38
29	16	19	16	28	16	38	16	49	17	02	17	21	16	16	16	40	17	09	17	16
30	17	01	17	07	17	13	17	20	17	28	17	39	16	51	17	18	17	41	17	52
Oct. 1	17	43	17	45	17	47	17	49	17	52	17	56	17	23	17	55	18	11	18	26

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2020
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Aug.	16	15	42	16	00	16	20	16	43	17	12	17	53	16	01	16	16	17	02	16	58
	17	16	39	16	56	17	15	17	36	18	02	18	39	16	56	17	11	17	55	17	53
	18	17	36	17	51	18	06	18	24	18	46	19	16	17	46	18	05	18	44	18	45
	19	18	32	18	43	18	55	19	08	19	24	19	46	18	34	18	56	19	28	19	33
	20	19	26	19	33	19	40	19	48	19	58	20	11	19	18	19	45	20	09	20	19
	21	20	18	20	21	20	23	20	26	20	29	20	34	20	00	20	31	20	48	21	03
	22	21	10	21	08	21	05	21	03	20	59	20	55	20	41	21	17	21	25	21	45
	23	22	01	21	55	21	48	21	40	21	30	21	17	21	22	22	02	22	03	22	28
	24	22	54	22	43	22	32	22	19	22	03	21	41	22	05	22	49	22	43	23	13
	25	23	48	23	33	23	18	23	01	22	39	22	10	22	50	23	39	23	26	24	00
	26	**	**	**	**	**	**	23	47	23	21	22	44	23	39	**	**	**	**	**	**
	27	0	43	0	26	0	08	**	**	**	**	23	28	**	**	0	31	0	13	0	50
	28	1	40	1	21	1	01	0	38	0	09	**	**	0	31	1	25	1	04	1	43
	29	2	36	2	17	1	57	1	33	1	04	0	21	1	27	2	21	1	59	2	39
	30	3	31	3	13	2	53	2	31	2	03	1	23	2	24	3	17	2	57	3	35
	31	4	23	4	07	3	50	3	30	3	05	2	30	3	21	4	12	3	56	4	31
Sept.	1	5	12	4	59	4	45	4	29	4	08	3	40	4	17	5	04	4	54	5	26
	2	5	58	5	48	5	38	5	26	5	11	4	50	5	11	5	55	5	50	6	19
	3	6	41	6	35	6	29	6	21	6	12	5	59	6	03	6	43	6	45	7	09
	4	7	23	7	21	7	18	7	15	7	11	7	06	6	53	7	29	7	38	7	58
	5	8	04	8	05	8	06	8	08	8	09	8	12	7	42	8	15	8	30	8	46
	6	8	44	8	49	8	54	9	00	9	07	9	17	8	32	9	00	9	22	9	34
	7	9	26	9	34	9	43	9	53	10	06	10	23	9	21	9	46	10	14	10	22
	8	10	09	10	20	10	33	10	47	11	05	11	29	10	12	10	33	11	07	11	11
	9	10	54	11	09	11	24	11	42	12	04	12	36	11	04	11	23	12	02	12	03
	10	11	42	11	59	12	17	12	38	13	05	13	42	11	58	12	14	12	57	12	55
	11	12	33	12	52	13	12	13	35	14	04	14	45	12	53	13	07	13	54	13	50
	12	13	27	13	46	14	07	14	30	15	00	15	42	13	48	14	02	14	49	14	45
	13	14	23	14	42	15	01	15	23	15	51	16	31	14	42	14	57	15	42	15	39
	14	15	20	15	36	15	53	16	13	16	37	17	11	15	34	15	51	16	32	16	32
	15	16	16	16	29	16	43	16	58	17	18	17	44	16	22	16	43	17	18	17	21
	16	17	11	17	20	17	30	17	40	17	54	18	11	17	08	17	33	18	01	18	09
	17	18	05	18	10	18	14	18	20	18	26	18	35	17	52	18	21	18	41	18	54
	18	18	58	18	58	18	58	18	57	18	57	18	57	18	34	19	07	19	20	19	37
	19	19	51	19	46	19	41	19	35	19	28	19	19	19	16	19	54	19	58	20	21
	20	20	45	20	36	20	26	20	15	20	01	19	42	19	59	20	43	20	39	21	07
	21	21	40	21	27	21	13	20	57	20	37	20	09	20	45	21	33	21	22	21	54
	22	22	37	22	21	22	03	21	43	21	18	20	43	21	34	22	25	22	08	22	45
	23	23	34	23	16	22	56	22	33	22	05	21	24	22	27	23	20	22	59	23	38
	24	**	**	**	**	23	52	23	28	22	58	22	15	23	22	**	**	23	54	**	**
	25	0	32	0	12	**	**	**	**	23	57	23	14	**	**	0	16	**	**	0	34
	26	1	27	1	08	0	49	0	26	**	**	**	**	0	19	1	12	0	52	1	31
	27	2	20	2	03	1	45	1	24	0	58	0	21	1	16	2	08	1	50	2	27
	28	3	09	2	55	2	40	2	23	2	01	1	30	2	12	3	01	2	48	3	22
	29	3	56	3	45	3	33	3	20	3	03	2	40	3	06	3	51	3	44	4	14
	30	4	40	4	32	4	24	4	15	4	04	3	48	3	58	4	40	4	39	5	05
Oct.	1	5	22	5	18	5	14	5	09	5	03	4	55	4	48	5	26	5	32	5	54

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE, 2020
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Oct.	1	17	43	17	45	17	47	17	49	17	52	17	56	17	23	17	55	18	11	18	26
	2	18	23	18	21	18	20	18	17	18	15	18	12	17	55	18	30	18	40	18	59
	3	19	04	18	58	18	53	18	46	18	38	18	28	18	27	19	06	19	09	19	33
	4	19	45	19	36	19	27	19	16	19	03	18	46	19	01	19	43	19	40	20	07
	5	20	29	20	16	20	04	19	49	19	31	19	06	19	36	20	22	20	13	20	44
	6	21	14	20	59	20	43	20	25	20	02	19	30	20	15	21	04	20	50	21	24
	7	22	02	21	45	21	26	21	05	20	38	20	01	20	57	21	49	21	31	22	08
	8	22	53	22	34	22	14	21	51	21	22	20	40	21	44	22	38	22	17	22	56
	9	23	46	23	27	23	06	22	42	22	12	21	29	22	36	23	30	23	09	23	48
	10	**	**	**	**	**	**	23	40	23	11	22	30	23	33	**	**	**	**	**	**
	11	0	40	0	22	0	02	**	**	**	**	23	40	**	**	0	26	0	06	0	44
	12	1	35	1	19	1	02	0	41	0	16	**	**	0	33	1	24	1	07	1	43
	13	2	30	2	17	2	03	1	46	1	26	0	58	1	34	2	22	2	11	2	44
	14	3	24	3	14	3	05	2	53	2	39	2	20	2	38	3	21	3	18	3	46
	15	4	17	4	12	4	07	4	01	3	54	3	44	3	41	4	20	4	25	4	48
	16	5	10	5	10	5	10	5	10	5	10	5	10	4	45	5	19	5	32	5	50
	17	6	03	6	08	6	14	6	20	6	27	6	37	5	51	6	20	6	41	6	53
	18	6	59	7	08	7	18	7	30	7	45	8	05	6	57	7	21	7	51	7	58
	19	7	56	8	10	8	24	8	41	9	02	9	32	8	04	8	23	9	01	9	03
	20	8	55	9	12	9	30	9	51	10	17	10	56	9	10	9	27	10	10	10	08
	21	9	54	10	13	10	34	10	57	11	27	12	10	10	15	10	29	11	16	11	12
	22	10	53	11	13	11	33	11	57	12	28	13	12	11	15	11	28	12	16	12	11
	23	11	50	12	08	12	28	12	51	13	19	14	00	12	09	12	24	13	09	13	06
	24	12	43	12	59	13	17	13	37	14	02	14	37	12	57	13	14	13	56	13	55
	25	13	32	13	46	14	00	14	17	14	37	15	05	13	40	13	59	14	36	14	38
	26	14	18	14	28	14	39	14	52	15	07	15	28	14	18	14	41	15	12	15	18
	27	15	01	15	08	15	15	15	23	15	33	15	47	14	53	15	19	15	44	15	54
	28	15	42	15	45	15	49	15	53	15	57	16	03	15	26	15	56	16	14	16	28
	29	16	23	16	22	16	22	16	21	16	20	16	19	15	58	16	31	16	43	17	01
	30	17	03	16	59	16	54	16	49	16	43	16	35	16	29	17	07	17	12	17	34
	31	17	44	17	36	17	28	17	19	17	07	16	52	17	02	17	43	17	42	18	08
Nov.	1	18	27	18	16	18	4	17	50	17	34	17	11	17	37	18	22	18	14	18	44
	2	19	12	18	57	18	42	18	25	18	03	17	34	18	14	19	03	18	50	19	23
	3	19	59	19	42	19	24	19	04	18	38	18	02	18	55	19	47	19	29	20	06
	4	20	49	20	30	20	10	19	47	19	19	18	38	19	41	20	34	20	13	20	52
	5	21	41	21	21	21	01	20	37	20	06	19	23	20	31	21	25	21	03	21	43
	6	22	34	22	15	21	55	21	31	21	01	20	19	21	25	22	19	21	57	22	37
	7	23	27	23	10	22	51	22	30	22	03	21	24	22	22	23	14	22	56	23	33
	8	**	**	**	**	23	50	23	32	23	09	22	37	23	21	**	**	23	57	**	**
	9	0	20	0	06	**	**	**	**	**	**	23	55	**	**	0	11	**	**	0	32
	10	1	12	1	01	0	49	0	36	0	19	**	**	0	22	1	07	1	00	1	31
	11	2	04	1	57	1	49	1	41	1	30	1	15	1	23	2	04	2	04	2	30
	12	2	55	2	52	2	50	2	47	2	43	2	38	2	24	3	01	3	10	3	30
	13	3	46	3	49	3	51	3	54	3	58	4	02	3	27	3	59	4	16	4	31
	14	4	40	4	47	4	55	5	03	5	14	5	29	4	32	4	59	5	25	5	34
	15	5	36	5	48	6	00	6	14	6	32	6	57	5	39	6	01	6	35	6	39
	16	6	35	6	51	7	07	7	26	7	50	8	25	6	47	7	05	7	46	7	46

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2020
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Oct.	1	5	22	5	18	5	14	5	09	5	03	4	55	4	48	5	26	5	32	5	54
	2	6	02	6	02	6	02	6	02	6	02	6	02	5	38	6	12	6	24	6	42
	3	6	43	6	46	6	50	6	55	7	00	7	07	6	27	6	57	7	16	7	30
	4	7	24	7	31	7	39	7	47	7	58	8	13	7	17	7	43	8	08	8	18
	5	8	06	8	17	8	28	8	41	8	57	9	19	8	07	8	29	9	01	9	07
	6	8	50	9	04	9	19	9	35	9	57	10	26	8	58	9	18	9	55	9	57
	7	9	37	9	53	10	11	10	31	10	56	11	33	9	51	10	08	10	50	10	49
	8	10	26	10	45	11	04	11	27	11	55	12	36	10	45	11	00	11	46	11	42
	9	11	18	11	37	11	58	12	22	12	52	13	35	11	39	11	53	12	40	12	36
	10	12	12	12	31	12	51	13	14	13	44	14	26	12	32	12	46	13	33	13	29
	11	13	07	13	24	13	43	14	04	14	31	15	08	13	24	13	39	14	23	14	21
	12	14	01	14	16	14	32	14	50	15	12	15	42	14	12	14	30	15	09	15	10
	13	14	55	15	07	15	18	15	32	15	48	16	11	14	58	15	20	15	52	15	57
	14	15	49	15	56	16	03	16	11	16	21	16	35	15	41	16	07	16	32	16	42
	15	16	42	16	44	16	47	16	49	16	53	16	57	16	23	16	54	17	11	17	26
	16	17	35	17	33	17	30	17	27	17	23	17	18	17	05	17	41	17	50	18	10
	17	18	29	18	22	18	15	18	06	17	55	17	41	17	48	18	30	18	29	18	55
	18	19	26	19	14	19	02	18	48	18	30	18	07	18	34	19	20	19	12	19	43
	19	20	24	20	08	19	52	19	33	19	10	18	38	19	23	20	13	19	58	20	34
	20	21	23	21	05	20	46	20	24	19	56	19	16	20	16	21	09	20	50	21	28
	21	22	23	22	03	21	43	21	19	20	49	20	05	21	13	22	07	21	45	22	25
	22	23	21	23	02	22	41	22	17	21	47	21	04	22	11	23	05	22	44	23	23
	23	**	**	23	58	23	39	23	17	22	50	22	10	23	10	**	**	23	43	**	**
	24	0	16	**	**	**	**	**	**	23	53	23	19	**	**	0	02	**	**	0	21
	25	1	07	0	52	0	35	0	17	**	**	**	**	0	07	0	57	0	42	1	17
	26	1	54	1	42	1	29	1	14	0	56	0	30	1	02	1	48	1	39	2	11
	27	2	39	2	30	2	21	2	10	1	57	1	39	1	54	2	37	2	34	3	02
	28	3	21	3	16	3	11	3	04	2	57	2	46	2	45	3	24	3	28	3	51
	29	4	02	4	00	3	59	3	57	3	55	3	53	3	34	4	10	4	20	4	39
	30	4	42	4	44	4	47	4	50	4	53	4	58	4	23	4	55	5	12	5	26
	31	5	23	5	29	5	35	5	42	5	52	6	04	5	13	5	40	6	04	6	14
Nov.	1	6	04	6	14	6	24	6	36	6	51	7	11	6	03	6	27	6	56	7	03
	2	6	48	7	01	7	15	7	30	7	50	8	18	6	54	7	15	7	50	7	53
	3	7	34	7	50	8	07	8	26	8	50	9	25	7	47	8	04	8	45	8	45
	4	8	23	8	41	9	00	9	22	9	50	10	30	8	41	8	56	9	41	9	38
	5	9	14	9	33	9	53	10	17	10	47	11	30	9	35	9	48	10	36	10	31
	6	10	06	10	26	10	46	11	10	11	40	12	23	10	28	10	41	11	29	11	24
	7	11	00	11	18	11	37	12	00	12	28	13	08	11	18	11	33	12	18	12	15
	8	11	53	12	09	12	26	12	45	13	10	13	44	12	06	12	23	13	05	13	04
	9	12	45	12	58	13	12	13	27	13	47	14	13	12	51	13	12	13	47	13	50
	10	13	37	13	46	13	55	14	06	14	19	14	37	13	34	13	58	14	27	14	34
	11	14	28	14	32	14	37	14	43	14	50	14	59	14	15	14	44	15	04	15	17
	12	15	19	15	19	15	19	15	19	15	19	15	20	14	55	15	29	15	41	15	59
	13	16	12	16	07	16	02	15	57	15	50	15	41	15	37	16	15	16	19	16	42
	14	17	06	16	57	16	47	16	36	16	22	16	04	16	20	17	04	17	00	17	28
	15	18	04	17	50	17	36	17	20	16	59	16	31	17	08	17	56	17	44	18	17
	16	19	04	18	47	18	29	18	08	17	43	17	06	18	00	18	52	18	34	19	11

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE, 2020
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T							
Date \ Lat.		0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Nov.	16	6	35	6	51	7	07	7	26	7	50	8	25	6	47	7	05	7	46	7	46
	17	7	36	7	54	8	14	8	37	9	05	9	47	7	55	8	10	8	56	8	52
	18	8	38	8	57	9	18	9	42	10	13	10	58	9	00	9	13	10	01	9	56
	19	9	38	9	57	10	18	10	41	11	11	11	54	9	59	10	13	11	00	10	56
	20	10	34	10	52	11	11	11	32	11	59	12	37	10	52	11	07	11	51	11	49
	21	11	27	11	41	11	57	12	15	12	38	13	09	11	38	11	56	12	35	12	35
	22	12	15	12	26	12	39	12	53	13	10	13	34	12	18	12	39	13	13	13	17
	23	12	59	13	07	13	16	13	26	13	38	13	54	12	54	13	19	13	46	13	55
	24	13	41	13	46	13	50	13	56	14	02	14	11	13	28	13	57	14	17	14	29
	25	14	22	14	22	14	23	14	24	14	25	14	27	14	00	14	32	14	46	15	03
	26	15	02	14	59	14	56	14	52	14	48	14	43	14	31	15	08	15	15	15	36
	27	15	42	15	36	15	29	15	21	15	12	14	59	15	03	15	43	15	44	16	09
	28	16	24	16	14	16	04	15	52	15	37	15	17	15	37	16	21	16	16	16	44
	29	17	09	16	55	16	41	16	25	16	05	15	38	16	14	17	01	16	50	17	22
	30	17	56	17	39	17	22	17	3	16	38	16	4	16	54	17	44	17	28	18	04
Dec.	1	18	45	18	27	18	08	17	45	17	17	16	37	17	38	18	31	18	11	18	49
	2	19	37	19	18	18	57	18	33	18	03	17	20	18	27	19	21	18	59	19	39
	3	20	30	20	11	19	50	19	26	18	56	18	12	19	20	20	15	19	52	20	32
	4	21	24	21	06	20	46	20	24	19	56	19	15	20	17	21	10	20	50	21	28
	5	22	16	22	01	21	44	21	25	21	00	20	26	21	15	22	05	21	50	22	26
	6	23	08	22	55	22	42	22	27	22	07	21	41	22	14	23	01	22	51	23	23
	7	23	58	23	49	23	40	23	29	23	16	22	58	23	13	23	56	23	53	**	**
	8	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0	21
	9	0	47	0	42	0	38	0	33	0	26	0	17	0	12	0	51	0	56	1	18
	10	1	36	1	36	1	36	1	37	1	37	1	37	1	12	1	46	1	59	2	16
	11	2	27	2	31	2	36	2	42	2	50	3	00	2	13	2	42	3	04	3	16
	12	3	19	3	29	3	39	3	50	4	04	4	24	3	17	3	41	4	11	4	18
	13	4	16	4	29	4	43	5	00	5	21	5	51	4	23	4	43	5	20	5	22
	14	5	15	5	32	5	50	6	11	6	37	7	15	5	30	5	47	6	30	6	29
	15	6	17	6	36	6	56	7	20	7	50	8	33	6	37	6	51	7	39	7	34
	16	7	19	7	38	7	59	8	24	8	54	9	39	7	41	7	54	8	42	8	37
	17	8	19	8	37	8	57	9	20	9	49	10	30	8	38	8	53	9	39	9	35
	18	9	15	9	31	9	48	10	08	10	33	11	08	9	29	9	46	10	27	10	26
	19	10	06	10	19	10	33	10	49	11	09	11	36	10	13	10	33	11	09	11	12
	20	10	53	11	03	11	13	11	25	11	39	11	59	10	52	11	15	11	45	11	52
	21	11	37	11	43	11	49	11	57	12	05	12	17	11	27	11	54	12	17	12	28
	22	12	19	12	21	12	23	12	26	12	29	12	34	12	00	12	31	12	47	13	02
	23	12	59	12	58	12	56	12	54	12	52	12	49	12	32	13	07	13	16	13	36
	24	13	39	13	34	13	29	13	23	13	15	13	05	13	03	13	42	13	46	14	09
	25	14	21	14	12	14	03	13	52	13	40	13	22	13	36	14	19	14	16	14	43
	26	15	04	14	52	14	39	14	25	14	07	13	42	14	12	14	58	14	49	15	20
	27	15	50	15	35	15	19	15	00	14	38	14	06	14	50	15	40	15	25	16	00
	28	16	39	16	21	16	03	15	41	15	14	14	37	15	33	16	25	16	07	16	44
	29	17	30	17	11	16	51	16	28	15	58	15	16	16	21	17	15	16	54	17	33
	30	18	24	18	05	17	44	17	20	16	49	16	05	17	14	18	08	17	46	18	26
	31	19	18	19	00	18	40	18	17	17	48	17	06	18	10	19	04	18	43	19	22
	32	20	12	19	56	19	38	19	18	18	52	18	15	19	09	20	00	19	43	20	20

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2020

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF MOONSET (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Nov.	16	19	04	18	47	18	29	18	08	17	43	17	06	18	00	18	52	18	34	19	11
	17	20	06	19	47	19	26	19	03	18	33	17	51	18	57	19	50	19	29	20	08
	18	21	07	20	47	20	26	20	02	19	31	18	47	19	56	20	51	20	28	21	08
	19	22	05	21	47	21	27	21	04	20	35	19	52	20	57	21	51	21	30	22	09
	20	23	00	22	44	22	26	22	06	21	40	21	03	21	57	22	48	22	31	23	08
	21	23	50	23	37	23	22	23	06	22	45	22	16	22	54	23	42	23	31	**	**
	22	**	**	**	**	**	**	**	**	23	48	23	27	23	49	**	**	**	**	0	04
	23	0	36	0	26	0	16	0	03	**	**	**	**	**	**	0	33	0	28	0	57
	24	1	20	1	13	1	06	0	59	0	49	0	36	0	40	1	21	1	22	1	47
	25	2	01	1	58	1	55	1	52	1	48	1	42	1	30	2	07	2	15	2	35
	26	2	41	2	42	2	43	2	44	2	46	2	48	2	19	2	52	3	07	3	23
	27	3	21	3	26	3	31	3	37	3	44	3	54	3	08	3	37	3	58	4	10
	28	4	03	4	11	4	20	4	30	4	43	5	00	3	58	4	23	4	51	4	59
	29	4	46	4	57	5	10	5	24	5	42	6	07	4	49	5	11	5	44	5	49
	30	5	31	5	46	6	02	6	20	6	43	7	15	5	42	6	00	6	39	6	40
Dec.	1	6	19	6	36	6	55	7	16	7	43	8	22	6	36	6	51	7	35	7	33
	2	7	10	7	29	7	49	8	12	8	42	9	25	7	30	7	44	8	31	8	27
	3	8	03	8	22	8	43	9	07	9	37	10	21	8	24	8	38	9	25	9	21
	4	8	56	9	15	9	35	9	58	10	27	11	08	9	16	9	30	10	17	10	13
	5	9	49	10	06	10	24	10	45	11	10	11	47	10	05	10	21	11	04	11	02
	6	10	41	10	55	11	10	11	27	11	48	12	17	10	50	11	09	11	47	11	48
	7	11	32	11	42	11	53	12	06	12	21	12	42	11	32	11	55	12	26	12	32
	8	12	21	12	27	12	34	12	42	12	51	13	04	12	12	12	39	13	03	13	13
	9	13	10	13	12	13	14	13	17	13	20	13	24	12	51	13	22	13	39	13	54
	10	14	00	13	57	13	55	13	52	13	48	13	43	13	30	14	06	14	14	14	35
	11	14	51	14	44	14	37	14	29	14	18	14	04	14	11	14	52	14	52	15	17
	12	15	46	15	34	15	22	15	09	14	52	14	29	14	55	15	40	15	33	16	03
	13	16	43	16	28	16	12	15	54	15	30	14	58	15	43	16	33	16	19	16	54
	14	17	44	17	26	17	07	16	45	16	17	15	37	16	37	17	30	17	10	17	49
	15	18	46	18	27	18	06	17	42	17	11	16	27	17	36	18	31	18	08	18	48
	16	19	48	19	29	19	08	18	44	18	13	17	29	18	38	19	32	19	10	19	50
	17	20	46	20	28	20	10	19	48	19	20	18	40	19	40	20	33	20	14	20	52
	18	21	40	21	25	21	09	20	51	20	27	19	55	20	40	21	30	21	16	21	51
	19	22	29	22	18	22	05	21	51	21	33	21	09	21	38	22	24	22	16	22	47
	20	23	15	23	07	22	58	22	49	22	37	22	20	22	32	23	14	23	13	23	39
	21	23	57	23	53	23	49	23	44	23	37	23	29	23	23	**	**	**	**	**	**
	22	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0	01	0	07	0	29
	23	0	38	0	38	0	37	0	37	0	36	0	36	0	13	0	47	0	59	1	17
	24	1	18	1	22	1	25	1	30	1	35	1	41	1	02	1	32	1	51	2	05
	25	1	59	2	06	2	14	2	22	2	33	2	47	1	52	2	18	2	43	2	53
	26	2	41	2	52	3	03	3	16	3	32	3	54	2	42	3	05	3	36	3	42
	27	3	26	3	40	3	54	4	11	4	32	5	02	3	34	3	53	4	31	4	33
	28	4	13	4	30	4	47	5	07	5	33	6	09	4	28	4	44	5	27	5	25
	29	5	03	5	22	5	41	6	04	6	33	7	15	5	23	5	37	6	23	6	20
	30	5	56	6	15	6	36	7	00	7	31	8	14	6	18	6	31	7	19	7	14
	31	6	50	7	09	7	30	7	53	8	23	9	06	7	11	7	25	8	12	8	08
	32	7	45	8	02	8	21	8	42	9	09	9	48	8	02	8	17	9	01	8	59

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE AND MOONSET
REDUCTION OF THE L.M.T. OF RISING OR SETTING FOR THE MERIDIAN OF 82°.5 E. LONGITUDE TO THE L.M.T. OF OTHER MERIDIANS

LONGITUDE EAST OF GREENWICH

Daily Variation in Rising or Setting	0°	30°	60°	68°	72°	76°	80°	84°	88°	92°	96°	120°	150°
m	m	m	m	m	m	m	m	m	m	m	m	m	m
28	+ 6.4	+ 4.1	+ 1.8	+ 1.1	+ 0.8	+ 0.5	+ 0.2	- 0.1	- 0.4	- 0.7	- 1.1	- 2.9	- 5.3
29	6.6	4.2	1.8	1.2	0.8	0.5	0.2	0.1	0.4	0.8	1.1	3.0	5.4
30	6.9	4.4	1.9	1.2	0.9	0.5	0.2	0.1	0.5	0.8	1.1	3.1	5.6
31	7.1	4.5	1.9	1.2	0.9	0.6	0.2	0.1	0.5	0.8	1.2	3.2	5.8
32	7.3	4.7	2.0	1.3	0.9	0.6	0.2	0.1	0.5	0.8	1.2	3.3	6.0
33	7.6	4.8	2.1	1.3	1.0	0.6	0.2	0.1	0.5	0.9	1.2	3.4	6.2
34	7.8	5.0	2.1	1.4	1.0	0.6	0.2	0.1	0.5	0.9	1.3	3.5	6.4
35	8.0	5.1	2.2	1.4	1.0	0.6	0.2	0.1	0.5	0.9	1.3	3.6	6.6
36	8.2	5.2	2.3	1.4	1.0	0.6	0.2	0.1	0.5	0.9	1.4	3.7	6.8
37	8.5	5.4	2.3	1.5	1.1	0.7	0.3	0.2	0.6	1.0	1.4	3.9	6.9
38	8.7	5.5	2.4	1.5	1.1	0.7	0.3	0.2	0.6	1.0	1.4	4.0	7.1
39	8.9	5.7	2.4	1.6	1.1	0.7	0.3	0.2	0.6	1.0	1.5	4.1	7.3
40	+ 9.2	+ 5.8	+ 2.5	+ 1.6	+ 1.2	+ 0.7	+ 0.3	- 0.2	- 0.6	- 1.1	- 1.5	- 4.2	- 7.5
41	9.4	6.0	2.6	1.7	1.2	0.7	0.3	0.2	0.6	1.1	1.5	4.3	7.7
42	9.6	6.1	2.6	1.7	1.2	0.8	0.3	0.2	0.6	1.1	1.6	4.4	7.9
43	9.9	6.3	2.7	1.7	1.3	0.8	0.3	0.2	0.7	1.1	1.6	4.5	8.1
44	10.1	6.4	2.8	1.8	1.3	0.8	0.3	0.2	0.7	1.2	1.7	4.6	8.3
45	10.3	6.6	2.8	1.8	1.3	0.8	0.3	0.2	0.7	1.2	1.7	4.7	8.4
46	10.5	6.7	2.9	1.9	1.3	0.8	0.3	0.2	0.7	1.2	1.7	4.8	8.6
47	10.8	6.9	2.9	1.9	1.4	0.8	0.3	0.2	0.7	1.2	1.8	4.9	8.8
48	11.0	7.0	3.0	1.9	1.4	0.9	0.3	0.2	0.7	1.3	1.8	5.0	9.0
49	11.2	7.1	3.1	2.0	1.4	0.9	0.3	0.2	0.7	1.3	1.8	5.1	9.2
50	+ 11.5	+ 7.3	+ 3.1	+ 2.0	+ 1.5	+ 0.9	+ 0.3	- 0.2	- 0.8	- 1.3	- 1.9	- 5.2	- 9.4
51	11.7	7.4	3.2	2.1	1.5	0.9	0.4	0.2	0.8	1.3	1.9	5.3	9.6
52	11.9	7.6	3.3	2.1	1.5	0.9	0.4	0.2	0.8	1.4	2.0	5.4	9.8
53	12.1	7.7	3.3	2.1	1.5	1.0	0.4	0.2	0.8	1.4	2.0	5.5	9.9
54	12.4	7.9	3.4	2.2	1.6	1.0	0.4	0.2	0.8	1.4	2.0	5.6	10.1
55	12.6	8.0	3.4	2.2	1.6	1.0	0.4	0.2	0.8	1.5	2.1	5.7	10.3
56	12.8	8.2	3.5	2.3	1.6	1.0	0.4	0.2	0.9	1.5	2.1	5.8	10.5
57	13.1	8.3	3.6	2.3	1.7	1.0	0.4	0.2	0.9	1.5	2.1	5.9	10.7
58	13.3	8.5	3.6	2.3	1.7	1.0	0.4	0.2	0.9	1.5	2.2	6.0	10.9
59	13.5	8.6	3.7	2.4	1.7	1.1	0.4	0.2	0.9	1.6	2.2	6.1	11.1
60	+ 13.7	+ 8.7	+ 3.8	+ 2.4	+ 1.7	+ 1.1	+ 0.4	- 0.2	- 0.9	- 1.6	- 2.3	- 6.2	- 11.3
61	14.0	8.9	3.8	2.5	1.8	1.1	0.4	0.3	0.9	1.6	2.3	6.4	11.4
62	14.2	9.0	3.9	2.5	1.8	1.1	0.4	0.3	0.9	1.6	2.3	6.5	11.6
63	14.4	9.2	3.9	2.5	1.8	1.1	0.4	0.3	1.0	1.7	2.4	6.6	11.8
64	14.7	9.3	4.0	2.6	1.9	1.2	0.4	0.3	1.0	1.7	2.4	6.7	12.0
65	14.9	9.5	4.1	2.6	1.9	1.2	0.5	0.3	1.0	1.7	2.4	6.8	12.2
66	15.1	9.6	4.1	2.7	1.9	1.2	0.5	0.3	1.0	1.7	2.5	6.9	12.4
67	15.4	9.8	4.2	2.7	2.0	1.2	0.5	0.3	1.0	1.8	2.5	7.0	12.6
68	15.6	9.9	4.3	2.7	2.0	1.2	0.5	0.3	1.0	1.8	2.6	7.1	12.8
69	15.8	10.1	4.3	2.8	2.0	1.2	0.5	0.3	1.1	1.8	2.6	7.2	12.9
70	+ 16.0	+ 10.2	+ 4.4	+ 2.8	+ 2.0	+ 1.3	+ 0.5	- 0.3	- 1.1	- 1.8	- 2.6	- 7.3	- 13.1
71	16.3	10.4	4.4	2.9	2.1	1.3	0.5	0.3	1.1	1.9	2.7	7.4	13.3
72	16.5	10.5	4.5	2.9	2.1	1.3	0.5	0.3	1.1	1.9	2.7	7.5	13.5
73	16.7	10.6	4.6	2.9	2.1	1.3	0.5	0.3	1.1	1.9	2.7	7.6	13.7
74	+ 17.0	+ 10.8	+ 4.6	+ 3.0	+ 2.2	+ 1.3	+ 0.5	- 0.3	- 1.1	- 2.0	- 2.8	- 7.7	- 13.9

SUNRISE, SUNSET AND MOONRISE, MOONSET
CORRECTION FOR LATITUDE

VARIATION PER 10° OF LATITUDE OF THE TIMES OF SUNRISE, SUNSET AND MOONRISE, MOONSET DISTRIBUTED OVER EACH DEGREE OF LATITUDE

Var. per 10° of Lat.	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	15'	30'	45'
m	m	m	m	m	m	m	m	m	m	m	m	m	m
5	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	0.1	0.3	0.4
6	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	0.2	0.3	0.5
7	0.7	1.4	2.1	2.8	3.5	4.2	4.9	5.6	6.3	7.0	0.2	0.4	0.5
8	0.8	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	8.0	0.2	0.4	0.6
9	0.9	1.8	2.7	3.6	4.5	5.4	6.3	7.2	8.1	9.0	0.2	0.5	0.7
10	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	0.3	0.5	0.8
11	1.1	2.2	3.3	4.4	5.5	6.6	7.7	8.8	9.9	11.0	0.3	0.6	0.8
12	1.2	2.4	3.6	4.8	6.0	7.2	8.4	9.6	10.8	12.0	0.3	0.6	0.9
13	1.3	2.6	3.9	5.2	6.5	7.8	9.1	10.4	11.7	13.0	0.3	0.7	1.0
14	1.4	2.8	4.2	5.6	7.0	8.4	9.8	11.2	12.6	14.0	0.4	0.7	1.1
15	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0	0.4	0.8	1.1
16	1.6	3.2	4.8	6.4	8.0	9.6	11.2	12.8	14.4	16.0	0.4	0.8	1.2
17	1.7	3.4	5.1	6.8	8.5	10.2	11.9	13.6	15.3	17.0	0.4	0.9	1.3
18	1.8	3.6	5.4	7.2	9.0	10.8	12.6	14.4	16.2	18.0	0.5	0.9	1.4
19	1.9	3.8	5.7	7.6	9.5	11.4	13.3	15.2	17.1	19.0	0.5	1.0	1.4
20	2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	0.5	1.0	1.5
21	2.1	4.2	6.3	8.4	10.5	12.6	14.7	16.8	18.9	21.0	0.5	1.1	1.6
22	2.2	4.4	6.6	8.8	11.0	13.2	15.4	17.6	19.8	22.0	0.6	1.1	1.7
23	2.3	4.6	6.9	9.2	11.5	13.8	16.1	18.4	20.7	23.0	0.6	1.2	1.7
24	2.4	4.8	7.2	9.6	12.0	14.4	16.8	19.2	21.6	24.0	0.6	1.2	1.8
25	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	25.0	0.6	1.3	1.9
26	2.6	5.2	7.8	10.4	13.0	15.6	18.2	20.8	23.4	26.0	0.7	1.3	2.0
27	2.7	5.4	8.1	10.8	13.5	16.2	18.9	21.6	24.3	27.0	0.7	1.4	2.0
28	2.8	5.6	8.4	11.2	14.0	16.8	19.6	22.4	25.2	28.0	0.7	1.4	2.1
29	2.9	5.8	8.7	11.6	14.5	17.4	20.3	23.2	26.1	29.0	0.7	1.5	2.2
30	3.0	6.0	9.0	12.0	15.0	18.0	21.0	24.0	27.0	30.0	0.8	1.5	2.3
31	3.1	6.2	9.3	12.4	15.5	18.6	21.7	24.8	27.9	31.0	0.8	1.6	2.3
32	3.2	6.4	9.6	12.8	16.0	19.2	22.4	25.6	28.8	32.0	0.8	1.6	2.4
33	3.3	6.6	9.9	13.2	16.5	19.8	23.1	26.4	29.7	33.0	0.8	1.7	2.5
34	3.4	6.8	10.2	13.6	17.0	20.4	23.8	27.2	30.6	34.0	0.9	1.7	2.6
35	3.5	7.0	10.5	14.0	17.5	21.0	24.5	28.0	31.5	35.0	0.9	1.8	2.6
36	3.6	7.2	10.8	14.4	18.0	21.6	25.2	28.8	32.4	36.0	0.9	1.8	2.7
37	3.7	7.4	11.1	14.8	18.5	22.2	25.9	29.6	33.3	37.0	0.9	1.9	2.8
38	3.8	7.6	11.4	15.2	19.0	22.8	26.6	30.4	34.2	38.0	1.0	1.9	2.9
39	3.9	7.8	11.7	15.6	19.5	23.4	27.3	31.2	35.1	39.0	1.0	2.0	2.9
40	4.0	8.0	12.0	16.0	20.0	24.0	28.0	32.0	36.0	40.0	1.0	2.0	3.0
41	4.1	8.2	12.3	16.4	20.5	24.6	28.7	32.8	36.9	41.0	1.0	2.1	3.1
42	4.2	8.4	12.6	16.8	21.0	25.2	29.4	33.6	37.8	42.0	1.1	2.1	3.2
43	4.3	8.6	12.9	17.2	21.5	25.8	30.1	34.4	38.7	43.0	1.1	2.2	3.2
44	4.4	8.8	13.2	17.6	22.0	26.4	30.8	35.2	39.6	44.0	1.1	2.2	3.3
45	4.5	9.0	13.5	18.0	22.5	27.0	31.5	36.0	40.5	45.0	1.1	2.3	3.4
46	4.6	9.2	13.8	18.4	23.0	27.6	32.2	36.8	41.4	46.0	1.2	2.3	3.5
47	4.7	9.4	14.1	18.8	23.5	28.2	32.9	37.6	42.3	47.0	1.2	2.4	3.5
48	4.8	9.6	14.4	19.2	24.0	28.8	33.6	38.4	43.2	48.0	1.2	2.4	3.6
49	4.9	9.8	14.7	19.6	24.5	29.4	34.3	39.2	44.1	49.0	1.2	2.5	3.7
50	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0	1.3	2.5	3.8

REDUCTION OF TIME

REDUCTION OF LOCAL MEAN TIME OF A PLACE INTO THE INDIAN STANDARD TIME

A-CORRECTION TO BE ADDED TO L.M.T. TO OBTAIN I.S.T.

	LONGITUDE OF PLACE (EAST OF GREENWICH)															
	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°
	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m
0	62.0	58.0	54.0	50.0	46.0	42.0	38.0	34.0	30.0	26.0	22.0	18.0	14.0	10.0	6.0	2.0
3	61.8	57.8	53.8	49.8	45.8	41.8	37.8	33.8	29.8	25.8	21.8	17.8	13.8	9.8	5.8	1.8
6	61.6	57.6	53.6	49.6	45.6	41.6	37.6	33.6	29.6	25.6	21.6	17.6	13.6	9.6	5.6	1.6
9	61.4	57.4	53.4	49.4	45.4	41.4	37.4	33.4	29.4	25.4	21.4	17.4	13.4	9.4	5.4	1.4
12	61.2	57.2	53.2	49.2	45.2	41.2	37.2	33.2	29.2	25.2	21.2	17.2	13.2	9.2	5.2	1.2
15	61.0	57.0	53.0	49.0	45.0	41.0	37.0	33.0	29.0	25.0	21.0	17.0	13.0	9.0	5.0	1.0
18	60.8	56.8	52.8	48.8	44.8	40.8	36.8	32.8	28.8	24.8	20.8	16.8	12.8	8.8	4.8	0.8
21	60.6	56.6	52.6	48.6	44.6	40.6	36.6	32.6	28.6	24.6	20.6	16.6	12.6	8.6	4.6	0.6
24	60.4	56.4	52.4	48.4	44.4	40.4	36.4	32.4	28.4	24.4	20.4	16.4	12.4	8.4	4.4	0.4
27	60.2	56.2	52.2	48.2	44.2	40.2	36.2	32.2	28.2	24.2	20.2	16.2	12.2	8.2	4.2	0.2
30	60.0	56.0	52.0	48.0	44.0	40.0	36.0	32.0	28.0	24.0	20.0	16.0	12.0	8.0	4.0	0.0
33	59.8	55.8	51.8	47.8	43.8	39.8	35.8	31.8	27.8	23.8	19.8	15.8	11.8	7.8	3.8	
36	59.6	55.6	51.6	47.6	43.6	39.6	35.6	31.6	27.6	23.6	19.6	15.6	11.6	7.6	3.6	
39	59.4	55.4	51.4	47.4	43.4	39.4	35.4	31.4	27.4	23.4	19.4	15.4	11.4	7.4	3.4	
42	59.2	55.2	51.2	47.2	43.2	39.2	35.2	31.2	27.2	23.2	19.2	15.2	11.2	7.2	3.2	
45	59.0	55.0	51.0	47.0	43.0	39.0	35.0	31.0	27.0	23.0	19.0	15.0	11.0	7.0	3.0	
48	58.8	54.8	50.8	46.8	42.8	38.8	34.8	30.8	26.8	22.8	18.8	14.8	10.8	6.8	2.8	
51	58.6	54.6	50.6	46.6	42.6	38.6	34.6	30.6	26.6	22.6	18.6	14.6	10.6	6.6	2.6	
54	58.4	54.4	50.4	46.4	42.4	38.4	34.4	30.4	26.4	22.4	18.4	14.4	10.4	6.4	2.4	
57	58.2	54.2	50.2	46.2	42.2	38.2	34.2	30.2	26.2	22.2	18.2	14.2	10.2	6.2	2.2	
60	58.0	54.0	50.0	46.0	42.0	38.0	34.0	30.0	26.0	22.0	18.0	14.0	10.0	6.0	2.0	

B- CORRECTION TO BE SUBTRACTED FROM L.M.T. TO OBTAIN I.S.T.

	LONGITUDE OF PLACE (EAST OF GREENWICH)															
	82°	83°	84°	85°	86°	87°	88°	89°	90°	91°	92°	93°	94°	95°	96°	97°
	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m
0		2.0	6.0	10.0	14.0	18.0	22.0	26.0	30.0	34.0	38.0	42.0	46.0	50.0	54.0	58.0
3		2.2	6.2	10.2	14.2	18.2	22.2	26.2	30.2	34.2	38.2	42.2	46.2	50.2	54.2	58.2
6		2.4	6.4	10.4	14.4	18.4	22.4	26.4	30.4	34.4	38.4	42.4	46.4	50.4	54.4	58.4
9		2.6	6.6	10.6	14.6	18.6	22.6	26.6	30.6	34.6	38.6	42.6	46.6	50.6	54.6	58.6
12		2.8	6.8	10.8	14.8	18.8	22.8	26.8	30.8	34.8	38.8	42.8	46.8	50.8	54.8	58.8
15		3.0	7.0	11.0	15.0	19.0	23.0	27.0	31.0	35.0	39.0	43.0	47.0	51.0	55.0	59.0
18		3.2	7.2	11.2	15.2	19.2	23.2	27.2	31.2	35.2	39.2	43.2	47.2	51.2	55.2	59.2
21		3.4	7.4	11.4	15.4	19.4	23.4	27.4	31.4	35.4	39.4	43.4	47.4	51.4	55.4	59.4
24		3.6	7.6	11.6	15.6	19.6	23.6	27.6	31.6	35.6	39.6	43.6	47.6	51.6	55.6	59.6
27		3.8	7.8	11.8	15.8	19.8	23.8	27.8	31.8	35.8	39.8	43.8	47.8	51.8	55.8	59.8
30	0.0	4.0	8.0	12.0	16.0	20.0	24.0	28.0	32.0	36.0	40.0	44.0	48.0	52.0	56.0	60.0
33	0.2	4.2	8.2	12.2	16.2	20.2	24.2	28.2	32.2	36.2	40.2	44.2	48.2	52.2	56.2	60.2
36	0.4	4.4	8.4	12.4	16.4	20.4	24.4	28.4	32.4	36.4	40.4	44.4	48.4	52.4	56.4	60.4
39	0.6	4.6	8.6	12.6	16.6	20.6	24.6	28.6	32.6	36.6	40.6	44.6	48.6	52.6	56.6	60.6
42	0.8	4.8	8.8	12.8	16.8	20.8	24.8	28.8	32.8	36.8	40.8	44.8	48.8	52.8	56.8	60.8
45	1.0	5.0	9.0	13.0	17.0	21.0	25.0	29.0	33.0	37.0	41.0	45.0	49.0	53.0	57.0	61.0
48	1.2	5.2	9.2	13.2	17.2	21.2	25.2	29.2	33.2	37.2	41.2	45.2	49.2	53.2	57.2	61.2
51	1.4	5.4	9.4	13.4	17.4	21.4	25.4	29.4	33.4	37.4	41.4	45.4	49.4	53.4	57.4	61.4
54	1.6	5.6	9.6	13.6	17.6	21.6	25.6	29.6	33.6	37.6	41.6	45.6	49.6	53.6	57.6	61.6
57	1.8	5.8	9.8	13.8	17.8	21.8	25.8	29.8	33.8	37.8	41.8	45.8	49.8	53.8	57.8	61.8
60	2.0	6.0	10.0	14.0	18.0	22.0	26.0	30.0	34.0	38.0	42.0	46.0	50.0	54.0	58.0	62.0

METHOD OF CALCULATION

Sunrise and Sunset

The local mean times of Sunrise and Sunset for latitudes 0° to 60° North at intervals of 4 days during the year have been given on pages 280 to 287. The timings relate to the visibility of the upper limb of the Sun on the horizon. From these tables the L.M.T. of rise or set for any day of the year and for any latitude of place can be obtained by simple interpolation. If the place is in the southern hemisphere, the corrections given on pages 290 to 291 will then have to be applied to the timings for the corresponding northern latitude. For a station in India, the timings of Sunrise and Sunset so obtained which are in L.M.T. can be reduced to I.S.T. by applying the correction given on page 314 according to the longitude of the station.

In addition to the above details given in the publication, the timings of Sunrise and Sunset of five important cities of India, viz., Kolkata, Varanasi, Chennai, Delhi and Mumbai have been specially calculated and given in I.S.T. on pages 292 to 295.

Sunrise and Sunset for Southern Latitudes

The timings of Sunrise and Sunset for southern latitudes, which have not been tabulated separately, can be deduced from those for the corresponding northern latitudes by applying the corrections given on pages 290 and 291.

Twilight

The timings of the beginning of morning twilight and ending of evening twilight have been given for latitudes 0° to 60° North on pages 280 to 287. The timings relate to the instant when the center of the Sun is 18° below the horizon. This is now known as astronomical twilight. The period of twilight has been divided into three parts - Civil when the Sun is 6° below the horizon, Nautical when 12° and Astronomical when 18° - and their durations have been given separately on pages 288 and 289 at an interval of 8 days. The figures for any intermediate date can be worked out from the tables by simple interpolation.

Moonrise and Moonset

The local mean times of Moonrise and Moonset for latitudes 0° to 50° North at 10- degrees interval together with the timings of these events in I.S.T. for four important stations in India, Viz., Kolkata, Chennai, Delhi and Mumbai for each day of the year have been given on pages 296 to 311 along with some supplementary tables on pages 312 to 313. A detailed method of calculation for any station is given below.

To find the time of Moonrise and Moonset for any station the figure for the phenomena concerned given against the date is to be taken from the table (pages 296 to 311) for the latitude just lower than the latitude of the station, to which the following corrections will have to be applied :

(a) Correction for difference in latitude;
(b) Correction for longitude, if the place is not on the Central Meridian of India (i.e., $82^\circ.5$ E. Long);
(c) Correction for converting L.M.T. into I.S.T., when and where necessary.

These corrections are detailed below :

(a) Correction for difference in latitude - The timings of Moonrise and Moonset have been given for latitudes 0°, 10°, 20°, 30°, 40° and 50° North, and in local mean time. The timing for any particular latitude of place falling within the above limits can be obtained by simple interpolation between figures for the two latitudes, one below and the other above the latitude of the given place. For this purpose the table on page 313 can be conveniently used wherein corrections for latitude are shown according to the variation per 10° of latitude of the timings of Moonrise or Moonset distributed over each degree of latitude. The correction can also be calculated directly by multiplying one-tenth of the time difference between the figures for two consecutive given latitudes by the excess of the latitude of the station over the given lower latitude.

METHOD OF CALCULATION

(b) Correction for difference in longitude - The timings thus obtained are exact for the Central Meridian of India, i.e, for longitude 82°.5 East of Greenwich. For other longitudes the correction given on page 312 should be applied according to :

(i) the longitude of the station, and
(ii) the daily variation of the timings of rising or setting, as the case may be, between two consecutive dates.

If greater accuracy is not required, the daily variation may be assumed to be a constant (i.e., 50 minutes) for all dates and corrections from the following table may be applied instead of taking the corrections from the table on page 312.

Longitude of Station (East)	Correction m	Longitude of Station (East)	Correction m
0°	+ 11.5	84°	- 0.2
30°	+ 7.3	88°	- 0.8
60°	+ 3.1	92°	- 1.3
68°	+ 2.0	96°	- 1.9
72°	+ 1.5	120°	- 5.2
76°	+ 0.9	150°	- 9.4
80°	+ 0.3	180°	- 13.5

The timing thus obtained by the above two operations is in L.M.T. of the station

(c) Correction for converting L.M.T. into I.S.T. - The figures obtained by the operations (a) and (b) above would give the local mean time of Moonrise or Moonset for the given station. The local mean time can be reduced to the Indian Standard Time by the help of the reduction table on page 314. In other way to obtain the I.S.T., the L.M.T. may be increased at the rate of 4 minutes per degree of longitude if the station is to the west of 82°.5 East and decreased at the same rate if the station is to the east of 82°.5 East Longitude.

In practice, however, when dealing with the same station, it will be convenient to combine corrections (b) and (c) above, as these are constant day after day, and add this constant to the daily times corrected for latitude only.

Moonrise and Moonset for southern Latitudes

The times of Moonrise and Moonset for southern latitudes have not been given separately. The timings for a station in southern latitude can, however, be deduced from those for the corresponding northern latitude by the following formula :

Timings for a southern latitude = 2 × Timing for 0° latitude - Timing for the same northern latitude.

In this case the local mean time for the same latitude north will have to be calculated first by applying the latitude correction (a) above, and the corresponding time for the southern latitude will have to be deduced by the above formula by utilising the published figure for 0° latitude. The exact L.M.T. of rising or setting for the place in question will, however, be obtained by applying the correction (b) above to the time so deduced.

If necessary, the timings thus obtained may be reduced to I.S.T. by the usual method.

PHASES OF THE MOON, 2020

(Time in I.S.T.)

		d	h	m			d	h	m
Full Moon	Dec,19	12	10	42	Full Moon	Jul	05	10	14
Last Quarter	Dec,19	19	10	27	Last Quarter	Jul	13	04	59
New Moon	Dec,19	26	10	43	New Moon	Jul	20	23	03
First Quarter	Jan, 20	03	10	15	First Quarter	Jul	27	18	03
Full Moon	Jan	11	00	51	Full Moon	Aug	03	21	29
Last Quarter	Jan	17	18	28	Last Quarter	Aug	11	22	15
New Moon	Jan	25	03	12	New Moon	Aug	19	08	12
First Quarter	Feb	02	07	12	First Quarter	Aug	25	23	28
Full Moon	Feb	09	13	03	Full Moon	Sep	02	10	52
Last Quarter	Feb	16	03	47	Last Quarter	Sep	10	14	56
New Moon	Feb	23	21	02	New Moon	Sep	17	16	30
First Quarter	Mar	03	01	27	First Quarter	Sep	24	07	25
Full Moon	Mar	09	23	18	Full Moon	Oct	02	02	35
Last Quarter	Mar	16	15	04	Last Quarter	Oct	10	06	10
New Moon	Mar	24	14	58	New Moon	Oct	17	01	01
First Quarter	Apr	01	15	51	First Quarter	Oct	23	18	53
Full Moon	Apr	08	08	05	Full Moon	Oct	31	20	19
Last Quarter	Apr	15	04	26	Last Quarter	Nov	08	19	16
New Moon	Apr	23	07	56	New Moon	Nov	15	10	37
First Quarter	May	01	02	08	First Quarter	Nov	22	10	15
Full Moon	May	07	16	15	Full Moon	Nov	30	15	00
Last Quarter	May	14	19	33	Last Quarter	Dec	08	06	07
New Moon	May	22	23	09	New Moon	Dec	14	21	47
First Quarter	May	30	09	00	First Quarter	Dec	22	05	11
Full Moon	Jun	06	00	42	Full Moon	Dec	30	08	58
Last Quarter	Jun	13	11	54	Last Quarter	Jan,21	06	15	07
New Moon	Jun	21	12	11	New Moon	Jan,21	13	10	30
First Quarter	Jun	28	13	46	First Quarter	Jan,21	21	02	32

PART - IV

ECLIPSES AND OCCULTATIONS

ECLIPSES, 2020

In the year 2020, there are two eclipses of the Sun.

I	June	21	Annular eclipse of the Sun	320–329
II	December	14	Total eclipse of the Sun	330–333

In addition, there are four penumbral eclipses of the Moon	January 10	334
	June 5	335
	July 5	336
	November 30	337

I- Annular eclipse of the Sun, June 21, 2020, Sunday.

Visible in India.

Area of Visibility

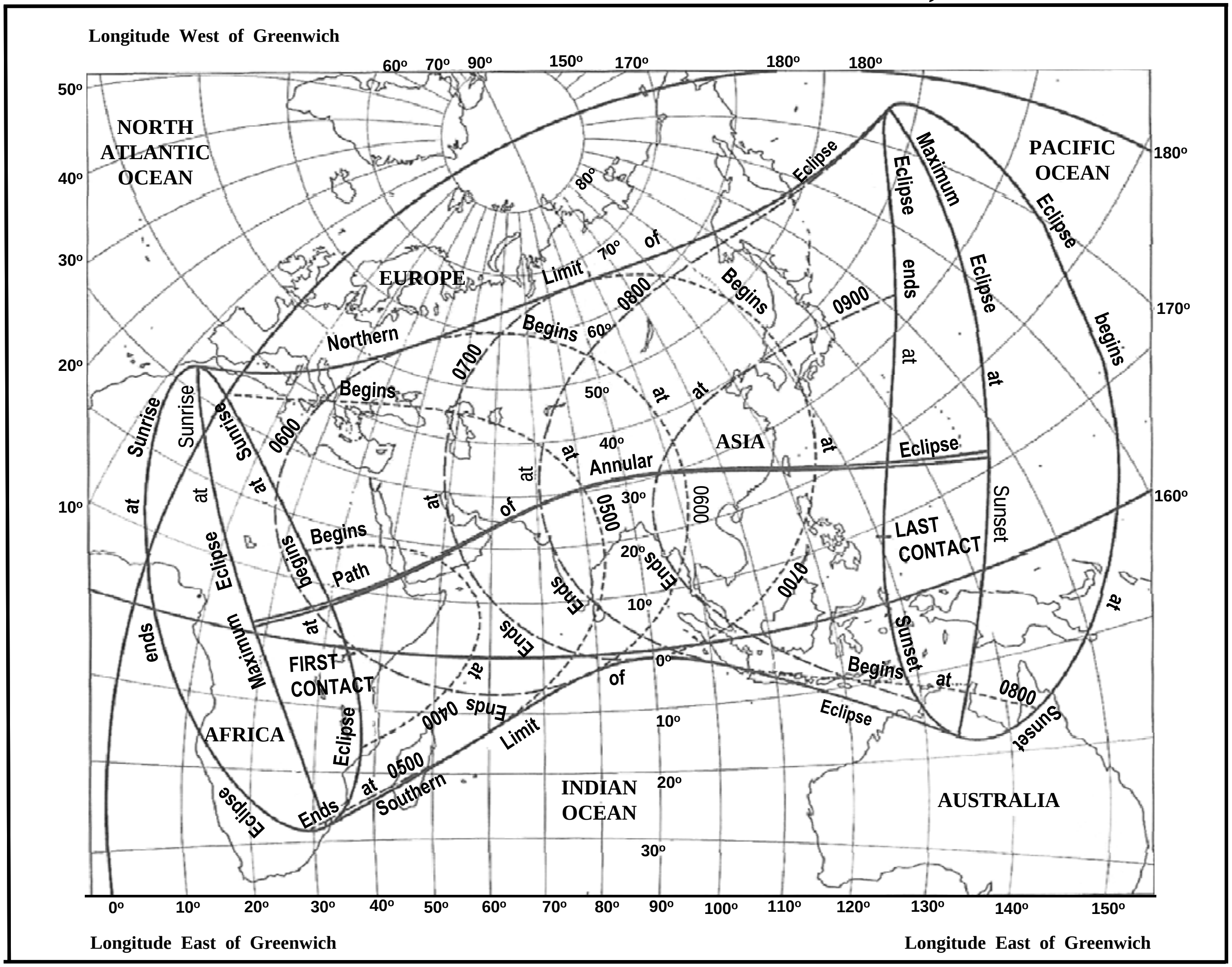
The eclipse is visible in the region covering Africa (except W. and S. parts), S. E. Europe, Middle East, Asia (except N and E. Russia), Indonesia, Micronesia.

ELEMENTS OF THE ECLIPSE						
Universal Time of Conjunction in Right Ascension : January 21^d 6^h 41^m $24^s.21$						
	MOON			SUN		
	h	m	s	h	m	s
Right Ascension	6	01	33.22	6	01	33.22
Hourly Motion			141.00			10.40
	°	'	"	°	'	"
Declination	23	32	59.68	23	26	09.7
Hourly Motion		2	55.55			-0.37
Equatorial Horizontal Parallax		56	31.12			08.65
True Semi-diameter		15	23.70		15	44.23

CIRCUMSTANCES OF THE ECLIPSE										
	Universal Time			Indian Standard Time			Latitude		Longitude	
	d	h	m	d	h	m	°	'	°	'
Eclipse begins	21	03	46.1	21	09	16.1	-1	01.9	+34	23.0
Central eclipse begins	21	04	48.5	21	10	18.5	+1	16.1	+17	47.9
Greatest eclipse*	21	06	40.1	21	12	10.1	+30	31.1	+79	40.1
Central eclipse ends	21	08	31.7	21	14	01.7	+11	28.0	+147	35.3
Eclipse ends	21	09	34.0	21	15	04.0	+9	10.5	+130	59.6

*Magnitude of the eclipse = 0.9936, Maximum duration of annular phase = 1 min 17 s

ANNULAR SOLAR ECLIPSE OF JUNE 21, 2020



The timings of beginning and ending are expressed in UT

ECLIPSES, 2020

BESSELIAN ELEMENTS OF THE ANNULAR ECLIPSE OF THE SUN
JUNE 21

Terrestrial Time (TT)		Co-ordinates of the Centre of Shadow on the Fundamental Plane		Direction of the Axis of Shadow *					Radius of Penumbra and Umbra on the Fundamental Plane	
h	m	x	y	sin d	cos d	μ °	'	"	l_1	l_2
3	40	-1.615715	-0.036646	+0.397731	+0.917502	234	32	18.5	+0.551682	+0.006661
	50	-1.527255	-0.027912	+0.397730	+0.917502	237	02	18.0	+0.551673	+0.006652
4	00	-1.438790	-0.019186	+0.397730	+0.917503	239	32	17.5	+0.551664	+0.006643
	10	-1.350320	-0.010469	+0.397729	+0.917503	242	02	16.9	+0.551654	+0.006633
	20	-1.261845	-0.001761	+0.397728	+0.917503	244	32	16.4	+0.551643	+0.006622
	30	-1.173365	+0.006939	+0.397728	+0.917503	247	02	15.8	+0.551632	+0.006611
	40	-1.084881	+0.015630	+0.397727	+0.917504	249	32	15.3	+0.551620	+0.006599
	50	-0.996392	+0.024312	+0.397727	+0.917504	252	02	14.8	+0.551608	+0.006587
5	00	-0.907900	+0.032985	+0.397726	+0.917504	254	32	14.2	+0.551595	+0.006574
	10	-0.819404	+0.041650	+0.397726	+0.917504	257	02	13.7	+0.551581	+0.006560
	20	-0.730904	+0.050305	+0.397725	+0.917505	259	32	13.2	+0.551567	+0.006546
	30	-0.642401	+0.058952	+0.397725	+0.917505	262	02	12.6	+0.551553	+0.006532
	40	-0.553894	+0.067590	+0.397724	+0.917505	264	32	12.1	+0.551537	+0.006516
	50	-0.465384	+0.076219	+0.397723	+0.917505	267	02	11.5	+0.551521	+0.006500
6	00	-0.376872	+0.084840	+0.397723	+0.917506	269	32	11.0	+0.551505	+0.006484
	10	-0.288356	+0.093451	+0.397722	+0.917506	272	02	10.5	+0.551488	+0.006467
	20	-0.199838	+0.102053	+0.397722	+0.917506	274	32	09.9	+0.551470	+0.006449
	30	-0.111318	+0.110646	+0.397721	+0.917506	277	02	09.4	+0.551452	+0.006431
	40	-0.022796	+0.119231	+0.397721	+0.917507	279	32	08.9	+0.551433	+0.006412
	50	+0.065729	+0.127806	+0.397720	+0.917507	282	02	08.3	+0.551413	+0.006393
7	00	+0.154255	+0.136372	+0.397719	+0.917507	284	32	07.8	+0.551393	+0.006372
	10	+0.242783	+0.144929	+0.397719	+0.917507	287	02	07.3	+0.551373	+0.006352
	20	+0.331312	+0.153477	+0.397718	+0.917508	289	32	06.7	+0.551351	+0.006330
	30	+0.419843	+0.162016	+0.397717	+0.917508	292	02	06.2	+0.551330	+0.006309
	40	+0.508374	+0.170546	+0.397717	+0.917508	294	32	05.6	+0.551307	+0.006286
	50	+0.596907	+0.179066	+0.397716	+0.917508	297	02	05.1	+0.551284	+0.006263
8	00	+0.685440	+0.187578	+0.397716	+0.917509	299	32	04.6	+0.551260	+0.006239
	10	+0.773973	+0.196080	+0.397715	+0.917509	302	02	04.0	+0.551236	+0.006215
	20	+0.862507	+0.204573	+0.397714	+0.917509	304	32	03.5	+0.551211	+0.006190
	30	+0.951042	+0.213056	+0.397714	+0.917509	307	02	03.0	+0.551186	+0.006165
	40	+1.039576	+0.221530	+0.397713	+0.917510	309	32	02.4	+0.551160	+0.006139
	50	+1.128109	+0.229995	+0.397712	+0.917510	312	02	01.9	+0.551133	+0.006112
9	00	+1.216643	+0.238451	+0.397712	+0.917510	314	32	01.3	+0.551106	+0.006085
	10	+1.305175	+0.246897	+0.397711	+0.917511	317	02	00.8	+0.551078	+0.006057
	20	+1.393707	+0.255334	+0.397710	+0.917511	319	32	00.3	+0.551049	+0.006028
	30	+1.482238	+0.263761	+0.397710	+0.917511	322	01	59.7	+0.551020	+0.005999
	40	+1.570768	+0.272179	+0.397709	+0.917511	324	31	59.2	+0.550991	+0.005970

tanf1= 0.00460834 tanf2= 0.00458542

TT hr	d °	'	"	Variations per minute x'	y'	μ' '	"
4	23	26	11	+0.008 847	0.000 872	15	00
5	23	26	10	+0.008 850	0.000 866	15	00
6	23	26	09	+0.008 852	0.000 861	15	00
7	23	26	08	+0.008 853	0.000 856	15	00
8	23	26	07	+0.008 853	0.000 850	15	00
9	23	26	06	+0.008 853	0.000 845	15	00

$\xi' = 0.004364\ \rho\cos\phi'\cos(\mu+\lambda)$ $\eta' = 0.004364\ \xi\sin d$

*d stands for declination and μ stands for hour angle

ECLIPSES, 2020

PATH OF CENTRAL PHASE DURING THE ANNULAR ECLIPSE OF THE SUN
JUNE 21

Terrestrial Time (TT)	Northern Limit		Central Line		Southern Limit		Central Line
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Duration of Annularity
	° ′	° ′	° ′	° ′	° ′	° ′	m s
Limit	+1 35.4	+17 36.4	+1 16.1	+17 47.9	-1 02.1	+34 24.7	------
h m							
4 50	+05 08.9	+25 20.1	+05 06.9	+26 04.8	+05 03.8	+26 46.0	1 21
5 00	+12 07.1	+38 38.0	+11 57.6	+38 55.2	+11 48.1	+39 12.1	1 12
10	16 03.0	45 30.7	15 53.7	45 42.9	15 44.3	45 54.9	1 07
20	19 02.9	50 43.2	18 54.1	50 52.6	18 45.3	51 02.0	1 02
30	21 30.3	55 07.0	21 22.0	55 14.6	21 13.8	55 22.1	0 58
40	23 34.5	59 03.1	23 26.7	59 09.2	23 18.9	59 15.3	0 54
50	+25 20.2	+62 42.3	+25 12.8	+62 47.2	+25 05.5	+62 52.1	0 51
6 00	+26 50.3	+66 11.2	+26 43.3	+66 15.2	+26 36.3	+66 19.2	0 49
10	28 06.2	69 34.4	27 59.5	69 37.6	27 52.8	69 40.7	0 47
20	29 09.1	72 54.9	29 02.6	72 57.3	28 56.0	72 59.8	0 45
30	29 59.4	76 15.1	29 52.9	76 16.9	29 46.5	76 18.7	0 44
40	30 37.2	79 37.0	30 30.8	79 38.2	30 24.4	79 39.4	0 43
50	+31 02.5	+83 02.3	+30 56.1	+83 02.9	+30 49.6	+83 03.4	0 43
7 00	+31 15.1	+86 32.6	+31 08.5	+86 32.5	+31 01.9	+86 32.4	0 44
10	31 14.2	90 09.6	31 07.4	90 08.8	31 00.6	90 08.1	0 45
20	30 59.2	93 55.5	30 52.0	93 53.9	30 44.9	93 52.3	0 46
30	30 28.5	97 52.8	30 21.0	97 50.2	30 13.4	97 47.7	0 48
40	29 40.4	102 05.5	29 32.4	102 01.8	29 24.3	101 58.1	0 51
50	+28 31.8	+106 39.6	+28 23.2	+106 34.4	+28 14.6	+106 29.2	0 54
8 00	+26 57.6	+111 45.4	+26 48.4	+111 38.2	+26 39.2	+111 31.1	0 57
10	24 48.2	117 43.1	24 38.4	117 33.0	24 28.7	117 23.1	1 02
20	21 40.0	125 23.4	21 30.1	125 08.1	21 20.1	124 53.1	1 07
30	+15 29.8	+139 21.4	+15 27.0	+138 39.6	+15 23.2	+138 0.8	1 15
Limit	+11 46.1	+147 46.4	+11 28.2	+147 35.2	+11 10.4	+147 24.3	-------

ECLIPSES, 2020

THE ANNULAR ECLIPSE OF THE SUN, JUNE 21

LOCAL CIRCUMSTANCES RELATING TO INDIA

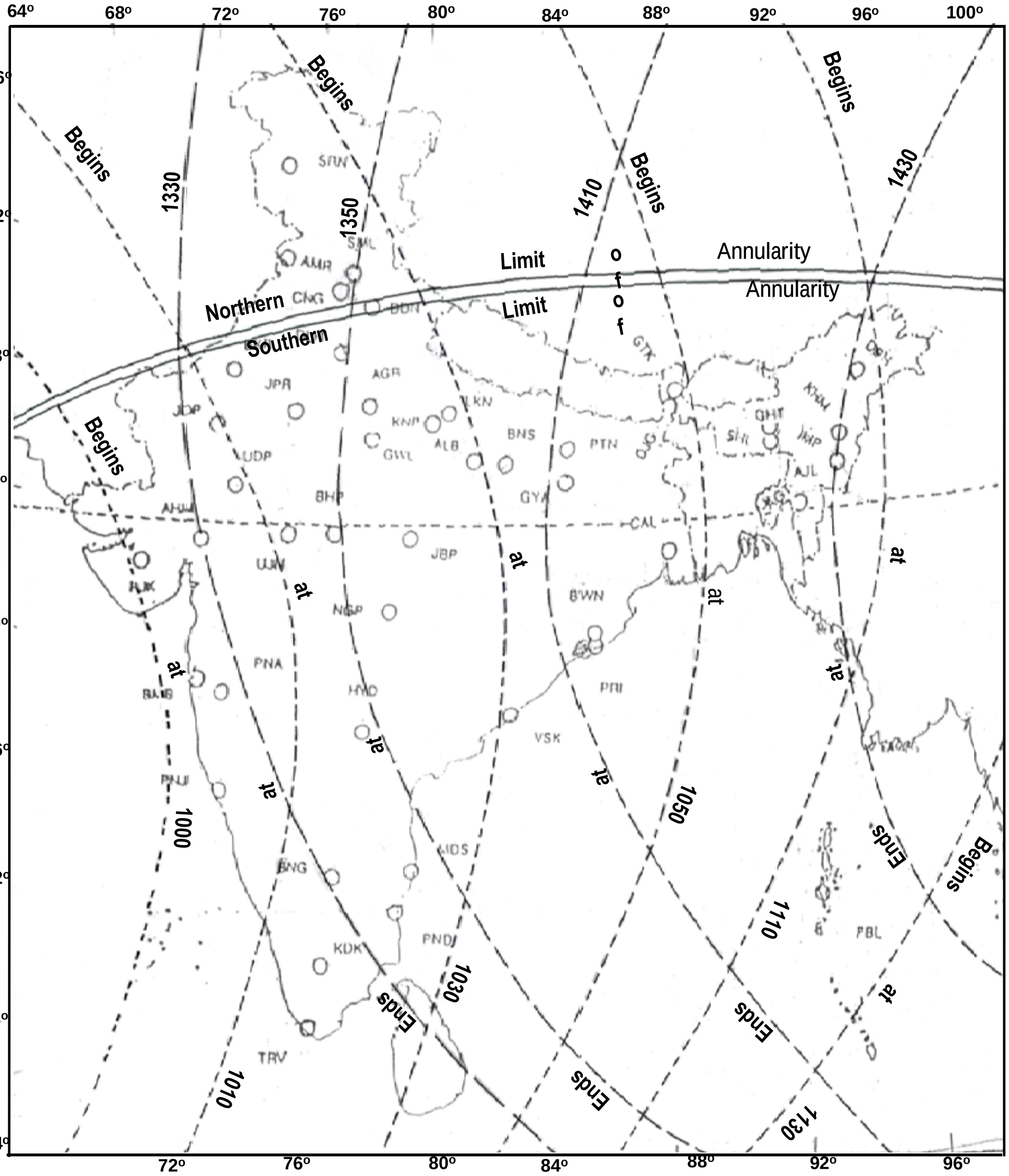
BEGINNING OF ECLIPSE FOR STATIONS IN INDIA
TIME IN I.S.T.

Lat (North)	Longitude East of Greenwich Beginning								
	68°	72°	76°	80°	84°	88°	92°	96°	100°
	h m	h m	h m	h m	h m	h m	h m	h m	h m
36°	10 18.0	10 23.4	10 29.8	10 37.1	10 45.4	10 54.5	11 04.2	11 14.3	11 24.6
32°	10 09.8	10 15.7	10 22.7	10 30.8	10 39.9	10 50.0	11 00.7	11 11.9	11 23.2
28°	10 02.7	10 09.1	10 16.8	10 25.7	10 35.8	10 46.9	10 58.7	11 11.0	11 23.2
24°	9 56.8	10 03.8	10 12.2	10 22.0	10 33.1	10 45.4	10 58.4	11 11.8	11 25.0
20°	9 52.2	9 59.9	10 09.1	10 19.9	10 32.2	10 45.8	11 00.2	11 14.7	11 28.8
16°	9 49.1	9 57.6	10 07.8	10 19.8	10 33.6	10 48.7	11 04.4	11 20.0	11 34.8
12°	9 47.7	9 57.2	10 08.6	10 22.2	10 37.7	10 54.6	11 11.8	11 28.4	11 43.5
8°	9 48.3	9 59.1	10 12.2	10 27.9	10 45.7	11 04.7	11 23.5	11 40.6	11 55.5

ENDING OF ECLIPSE FOR STATIONS IN INDIA
TIME IN I.S.T.

Lat (North)	Longitude East of Greenwich Beginning								
	68°	72°	76°	80°	84°	88°	92°	96°	100°
	h m	h m	h m	h m	h m	h m	h m	h m	h m
36°	13 21.8	13 32.3	13 42.3	13 51.6	14 00.2	14 08.0	14 14.8	14 20.6	14 25.5
32°	13 22.5	13 33.7	13 44.5	13 54.7	14 04.0	14 12.5	14 19.8	14 26.2	14 31.5
28°	13 21.4	13 33.4	13 45.0	13 56.0	14 06.2	14 15.3	14 23.4	14 30.3	14 36.1
24°	13 18.5	13 31.0	13 43.4	13 55.3	14 16.4	14 25.2	14 32.8	14 32.8	14 39.2
20°	13 13.4	13 26.5	13 39.6	13 52.3	14 04.3	14 15.3	14 25.0	14 33.5	14 40.5
16°	13 06.0	13 19.3	13 33.0	13 46.6	13 59.6	14 11.8	14 22.6	14 32.0	14 40.0
12°	12 56.2	13 09.3	13 23.2	13 37.5	13 51.6	14 05.1	14 17.3	14 28.1	14 37.2
8°	12 43.8	12 56.1	13 09.6	13 24.1	13 39.2	13 54.2	14 08.3	14 20.8	14 31.5

ANNULAR SOLAR ECLIPSE OF JUNE 21, 2020



The timings of beginning and ending are expressed in IST

ECLIPSES, 2020

THE ANNULAR ECLIPSE OF THE SUN, JUNE 21
PHASES OF ECLIPSE VISIBLE FROM CERTAIN PLACES OF INDIA AND ITS NEIGHBOURHOOD

Places	Partial Eclipse Begins (IST)	Position Angles at Eclipse Begins	Annular phase Begins (IST)	Greatest Eclipse (IST)	Magni-tude	Max-imum Obscu-ration	Annular phase Ends (IST)	Partial Eclipse Ends (IST)	Position Angles at Eclipse Ends	Dura-tion of Eclipse
	h m	P V	h m	h m			h m	h m	P V	h m
Agartala	10 56.0	275 1	- -	12 45.1	0.771	71.1%	- -	14 23.6	77 356	3 28
Ahmadabad	10 04.0	263 346	- -	11 42.2	0.823	77.4%	- -	13 32.2	70 340	3 28
Aijwal	11 00.9	276 3	- -	12 49.8	0.770	70.9%	- -	14 26.7	77 357	3 26
Ajmer	10 11.9	260 337	- -	11 51.9	0.906	87.9%	- -	13 40.6	76 0	3 29
Allahabad	10 27.6	267 347	- -	12 13.6	0.831	78.4%	- -	14 00.6	75 356	3 33
Amritsar	10 20.0	252 319	- -	11 57.7	0.935	91.5%	- -	13 41.6	85 27	3 22
Bangalore	10 13.2	285 29	- -	11 47.6	0.473	36.5%	- -	13 31.5	50 290	3 18
Bhagalpur	10 42.4	270 350	- -	12 30.9	0.811	76.0%	- -	14 13.8	77 358	3 31
Bhopal	10 14.7	267 351	- -	11 57.4	0.789	73.2%	- -	13 47.0	70 344	3 32
Bhubaneswar	10 38.3	279 17	- -	12 26.1	0.655	57.0%	- -	14 09.7	67 338	3 31
Cannanore	10 06.7	285 28	- -	11 37.5	0.461	35.2%	- -	13 20.4	47 274	3 14
*Chamoli	10 27.1	257 325	12 08.7	12 09.1	0.997	98.6%	12 09.4	13 53.7	84 16	3 27
Chandigarh	10 24.4	254 322	- -	12 04.5	0.965	95.4%	- -	13 48.7	85 21	3 24
Chennai	10 22.0	288 35	- -	11 58.5	0.453	34.4%	- -	13 40.8	50 298	3 19
Cochin	10 11.0	290 37	- -	11 38.9	0.396	28.4%	- -	13 17.7	43 267	3 07
Cooch Behar	10 50.5	270 342	- -	12 39.0	0.846	80.3%	- -	14 19.2	80 3	3 29
Cuttack	10 38.6	278 16	- -	12 26.6	0.661	57.8%	- -	14 10.1	68 339	3 31
Darjeeling	10 47.2	268 339	- -	12 35.2	0.868	83.1%	- -	14 16.3	81 5	3 29
*Dehradun	10 24.2	256 325	12 05.0	12 05.3	0.996	98.6%	12 05.6	13 50.4	83 17	3 26
Delhi	10 20.1	258 332	- -	12 01.6	0.952	93.7%	- -	13 48.4	80 9	3 28
Dibrugarh	11 07.9	270 282	- -	12 54.7	0.896	86.5%	- -	14 29.1	85 11	3 21
Dwarka	9 56.6	262 344	- -	11 31.1	0.840	79.5%	- -	13 20.1	69 328	3 24
Gandhinagar	10 04.3	263 346	- -	11 42.6	0.827	77.9%	- -	13 32.6	70 341	3 28
Gangtok	10 48.3	268 336	- -	12 36.2	0.877	84.2%	- -	14 17.0	81 6	3 28
Gaya	10 36.2	270 352	- -	12 24.2	0.799	74.4%	- -	14 08.9	75 355	3 33
Guwahati	10 57.0	271 338	- -	12 45.5	0.842	79.8%	- -	14 23.6	81 4	3 27
Haridwar	10 24.9	256 324	- -	12 06.0	0.990	98.6%	- -	13 50.8	84 18	3 26
Hazaribagh	10 37.2	272 356	- -	12 25.4	0.774	71.4%	- -	14 09.9	74 352	3 33
Hubli	10 06.0	277 13	- -	11 42.6	0.586	49.1%	- -	13 30.8	56 301	3 25
Hyderabad	10 15.0	278 14	- -	11 55.8	0.602	50.8%	- -	13 43.9	59 316	3 29
Imphal	11 04.6	275 342	- -	12 53.0	0.804	75.0%	- -	14 28.7	80 1	3 24
Itanagar	11 03.5	270 311	- -	12 51.1	0.879	84.4%	- -	14 26.9	84 9	3 23
Jaipur	10 14.8	260 337	- -	11 55.8	0.908	88.1%	- -	13 44.2	77 1	3 29
Jalandhar	10 22.7	252 318	- -	12 01.0	0.931	91.0%	- -	13 44.5	86 27	3 22
Jammu	10 21.7	250 316	- -	11 58.5	0.904	87.5%	- -	13 41.2	87 32	3 20
*Joshimath	10 27.8	257 325	12 09.5	12 09.8	0.997	98.6%	12 10.2	13 54.3	84 17	3 27

‘ - - ‘ indicates annular phase of eclipse is not visible corresponding to the places where only partial eclipse occurs

‘*’ Places where annular phase of eclipse occurs

ECLIPSES, 2020

THE ANNULAR ECLIPSE OF THE SUN, JUNE 21

PHASES OF ECLIPSE VISIBLE FROM CERTAIN PLACES OF INDIA AND ITS NEIGHBOURHOOD

Places	Partial Eclipse Begins (IST)	Position Angles at Eclipse Begins	Annular phase Begins (IST)	Greatest Eclipse (IST)	Magnitude	Maximum Obscuration	Annular phase Ends (IST)	Partial Eclipse Ends (IST)	Position Angles at Eclipse Ends	Duration of Eclipse
	h m	P V	h m	h m			h m	h m	P V	h m
Kanyakumari	10 17.7	295 47	- -	11 41.9	0.329	21.9%	- -	13 15.3	38 260	2 58
Kavalur	10 19.2	287 33	- -	11 55.1	0.458	34.9%	- -	13 37.9	50 295	3 19
Kavaratti	10 00.3	284 26	- -	11 28.0	0.460	35.1%	- -	13 09.7	45 256	3 09
Kohima	11 05.3	273 320	- -	12 53.3	0.835	78.9%	- -	14 28.8	81 4	3 23
Kolhapur	10 03.2	275 9	- -	11 39.5	0.617	52.6%	- -	13 28.3	57 301	3 25
Kolkata	10 46.4	276 8	- -	12 35.5	0.725	65.5%	- -	14 17.0	73 349	3 31
Koraput	10 28.2	279 17	- -	12 13.5	0.619	52.8%	- -	13 59.4	63 329	3 31
Kozikode	10 08.4	287 31	- -	11 38.5	0.439	32.9%	- -	13 20.2	46 273	3 12
Kurnool	10 13.8	280 19	- -	11 52.6	0.554	45.4%	- -	13 39.6	56 307	3 26
*Kurukshetra	10 21.3	256 326	12 01.4	12 01.8	0.997	98.6%	12 02.1	13 47.4	83 16	3 26
Lucknow	10 26.8	264 40	- -	12 11.8	0.879	84.4%	- -	13 58.5	78 1	3 32
Madurai	10 17.6	292 42	- -	11 46.5	0.377	26.6%	- -	13 24.3	43 274	3 07
Mangalore	10 04.9	283 23	- -	11 37.1	0.498	39.1%	- -	13 21.8	49 279	3 17
Midnapore	10 43.0	276 7	- -	12 32.0	0.722	65.0%	- -	14 14.5	72 348	3 31
Mount Abu	10 05.9	261 341	- -	11 44.3	0.868	83.0%	- -	13 33.8	72 350	3 28
Mumbai	10 00.9	270 360	- -	11 37.5	0.697	62.1%	- -	13 27.5	62 311	3 27
Murshidabad	10 47.0	273 357	- -	12 36.1	0.782	72.4%	- -	14 17.5	76 356	3 30
Muzaffarpur	10 38.3	268 345	- -	12 26.0	0.841	79.7%	- -	14 10.0	78 360	3 32
Mysore	10 10.7	286 29	- -	11 43.4	0.461	35.2%	- -	13 26.5	48 283	3 16
Nagpur	10 17.9	272 1	- -	12 01.6	0.711	63.7%	- -	13 50.7	67 335	3 33
Nalgonda	10 17.3	279 17	- -	11 58.4	0.582	48.6%	- -	13 45.8	58 316	3 28
Nasik	10 03.8	269 357	- -	11 42.0	0.720	64.8%	- -	13 32.3	64 321	3 29
Nellore	10 20.4	285 29	- -	11 59.0	0.499	39.3%	- -	13 43.4	53 305	3 23
Nowgong	10 21.4	266 346	- -	12 05.8	0.830	78.3%	- -	13 54.1	74 353	3 33
Panaji	10 03.3	277 12	- -	11 38.8	0.589	49.3%	- -	13 26.9	55 296	3 24
Patna	10 37.1	269 348	- -	12 24.9	0.825	77.7%	- -	14 09.3	77 358	3 32
Pondicherry	10 21.7	290 39	- -	11 56.0	0.423	31.2%	- -	13 36.7	48 291	3 15
Port Blair	11 15.6	301 114	- -	12 53.4	0.393	28.1%	- -	14 18.8	54 316	3 03
Pune	10 03.0	272 2	- -	11 40.5	0.675	59.5%	- -	13 30.3	61 312	3 27
Puri	10 38.3	279 19	- -	12 26.0	0.641	55.4%	- -	14 09.3	66 337	3 31
Raipur	10 25.1	274 5	- -	12 10.9	0.699	62.3%	- -	13 58.4	68 338	3 33
Rajamundry	10 27.1	282 24	- -	12 10.6	0.564	46.5%	- -	13 55.7	59 321	3 29
Rajkot	9 59.6	263 346	- -	11 35.8	0.819	77.0%	- -	13 25.5	68 332	3 26
Ranchi	10 36.8	273 360	- -	12 25.0	0.753	68.8%	- -	14 09.6	73 349	3 33
Sambalpur	10 32.2	275 7	- -	12 19.6	0.697	62.1%	- -	14 05.3	69 341	3 33
Shillong	10 58.0	272 343	- -	12 46.6	0.826	77.8%	- -	14 24.5	80 2	3 27

‘ - - ‘ indicates annular phase of eclipse is not visible corresponding to the places where only partial eclipse occurs

‘*’ Places where annular phase of eclipse occurs

ECLIPSES, 2020

THE ANNULAR ECLIPSE OF THE SUN, JUNE 21

PHASES OF ECLIPSE VISIBLE FROM CERTAIN PLACES OF INDIA AND ITS NEIGHBOURHOOD

Places	Partial Eclipse Begins (IST)	Position Angles at Eclipse Begins	Annular phase Begins (IST)	Greatest Eclipse (IST)	Magni-tude	Max-imum Obscu-ration	Annular phase Ends (IST)	Partial Eclipse Ends (IST)	Position Angles at Eclipse Ends	Dura-tion of Eclipse
	h m	P V	h m	h m			h m	h m	P V	h m
Shimla	10 23.5	254 322	- -	12 03.4	0.967	95.6%	- -	13 47.9	85 21	3 24
Sibsagar	11 06.7	271 294	- -	12 54.0	0.879	84.4%	- -	14 28.8	84 9	3 22
Silchar	11 01.0	274 349	- -	12 49.7	0.803	74.9%	- -	14 26.6	79 0	3 26
Siliguri	10 47.3	269 341	- -	12 35.5	0.856	81.6%	- -	14 16.7	80 4	3 29
Silvassa	10 02.4	268 355	- -	11 40.1	0.741	67.4%	- -	13 30.4	65 322	3 28
*Sirsa	10 16.9	255 327	11 55.9	11 56.1	0.996	98.6%	11 56.6	13 42.3	82 16	3 25
Srinagar	10 24.2	248 310	- -	11 59.7	0.861	82.2%	- -	13 40.6	90 39	3 16
Sringeri	10 06.7	282 22	- -	11 40.6	0.514	40.9%	- -	13 26.2	51 287	3 20
*Suratgarh	10 14.5	255 327	11 52.5	11 52.9	0.998	98.6%	11 53.3	13 39.2	81 17	3 25
Tamelong	11 04.8	274 335	- -	12 53.1	0.814	76.4%	- -	14 28.7	80 2	3 24
Thanjavur	10 20.3	291 41	- -	11 51.8	0.394	28.3%	- -	13 30.8	45 283	3 10
Thiruvanantapuram	10 15.1	294 44	- -	11 40.0	0.346	23.5%	- -	13 14.9	39 260	3 00
Tiruneveil	10 18.6	293 45	- -	11 45.9	0.356	24.5%	- -	13 21.9	41 270	3 03
Trichur	10 10.7	288 34	- -	11 40.5	0.420	30.9%	- -	13 21.2	45 273	3 10
Udaipur	10 07.8	262 343	- -	11 47.2	0.858	81.8%	- -	13 36.8	72 350	3 29
Ujjain	10 10.9	266 350	- -	11 52.1	0.798	74.3%	- -	13 42.2	70 342	3 31
Vadodara	10 04.6	265 349	- -	11 43.2	0.795	73.9%	- -	13 33.5	68 335	3 29
Varanasi	10 31.0	268 348	- -	12 17.8	0.821	77.2%	- -	14 04.0	76 356	3 33
Vijayawada	10 21.7	281 22	- -	12 03.4	0.558	45.9%	- -	13 49.5	58 316	3 28
Chittagong	10 59.9	277 11	- -	12 49.0	0.749	68.3%	- -	14 26.1	76 355	3 26
Colombo	10 30.8	300 60	- -	11 54.6	0.286	18.0%	- -	13 23.8	37 268	2 53
Dhaka	10 54.1	274 358	- -	12 43.3	0.779	72.0%	- -	14 22.4	77 357	3 28
Islamabad	10 21.8	247 310	- -	11 56.0	0.848	80.5%	- -	13 36.5	90 43	3 15
Karachi	9 57.2	255 333	- -	11 30.0	0.952	93.6%	- -	13 16.7	75 17	3 19
Kathmandu	10 39.5	264 335	- -	12 26.1	0.906	87.8%	- -	14 09.3	82 7	3 30
Lahore	10 19.9	251 318	- -	11 57.0	0.922	89.8%	- -	13 40.5	86 29	3 21
Rwalpindi	10 21.1	247 310	- -	11 55.3	0.852	81.1%	- -	13 36.1	90 43	3 15
Thimpu	10 52.6	267 330	- -	12 40.3	0.893	86.1%	- -	14 19.6	83 8	3 27
Yangon	11 19.0	290 135	- -	13 04.1	0.585	48.8%	- -	14 33.3	68 341	3 14

‘ - - ‘ indicates annular phase of eclipse is not visible corresponding to the places where only partial eclipse occurs

‘*’ Places where annular phase of eclipse occurs

ECLIPSES, 2020

ANNULAR SOLAR ECLIPSE, JUNE 21, 2020

LOCAL CIRCUMSTANCES RELATING TO PLACES FROM WHERE ANNULAR PHASE IS VISIBLE

Places	Annular phase Begins (IST)	Greatest Eclipse (IST)	Maximum Obscuration	Annular phase Ends (IST)	Duration of Annularity
	h m	h m		h m	m s
Chamoli	12 08.7	12 09.1	98.6%	12 09.4	0 38
Dehradun	12 05.0	12 05.3	98.6%	12 05.6	0 31
Joshimath	12 09.5	12 09.8	98.6%	12 10.2	0 39
Kurukshetra	12 01.4	12 01.8	98.6%	12 02.1	0 39
Sirsa	11 55.9	11 56.1	98.6%	11 56.4	0 36
Suratgarh	11 52.5	11 52.9	98.6%	11 53.3	0 45

ECLIPSES, 2020

II- Total eclipse of the Sun December 14, 2020, Monday

Not Visible in India.

Area of Visibility

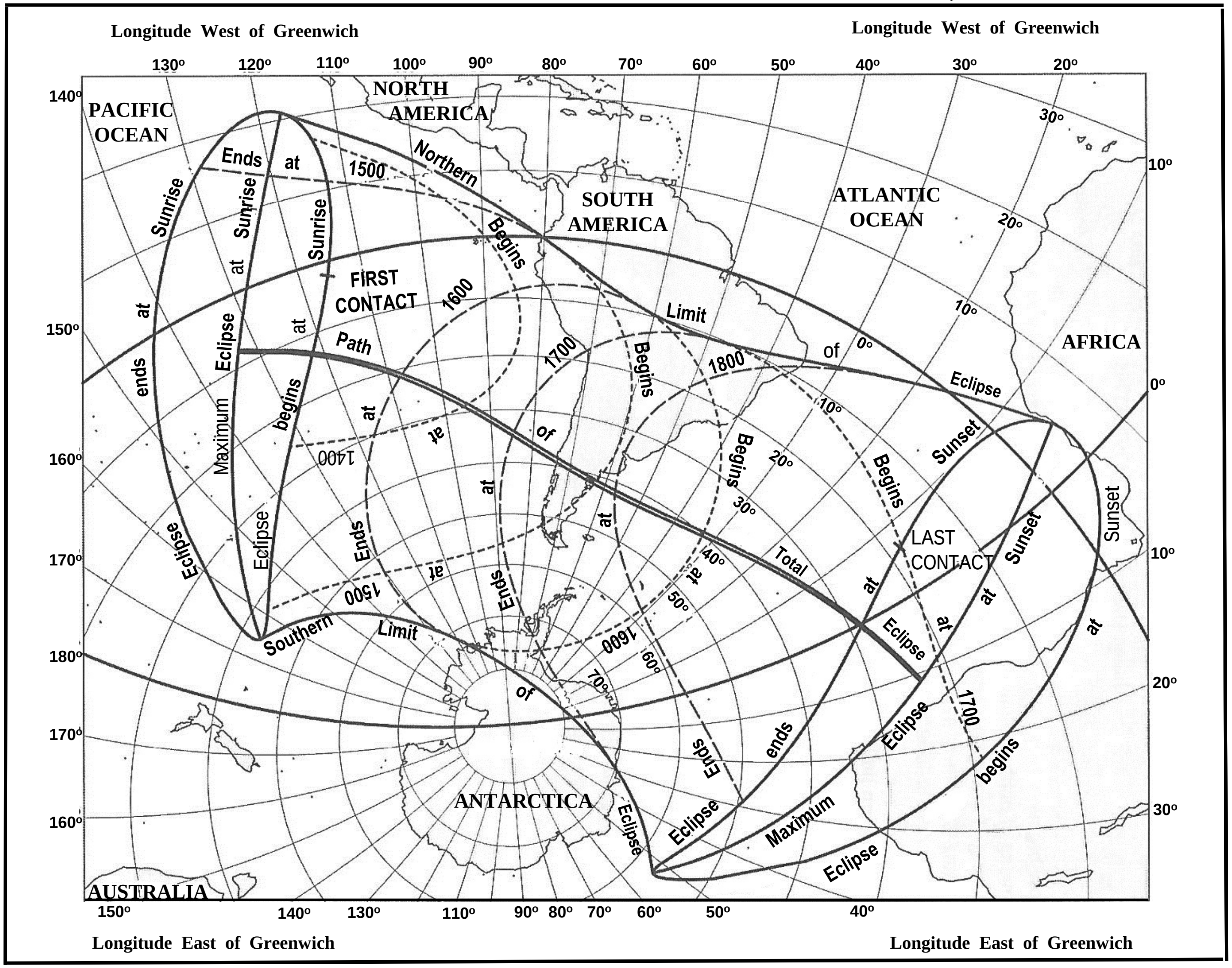
The eclipse is visible in the region covering Southern Pacific Ocean, Galapogos Islands, South America, (except N. Parts), Parts of Antarctica and parts of S.W. Africa.

ELEMENTS OF THE ECLIPSE						
Universal Time of Conjunction in Right Ascension : December 14^d 16^h 18^m $12^s.35$						
	MOON			SUN		
	h	m	s	h	m	s
Right Ascension	17	30	06.77	17	30	06.77
Hourly Motion			158.63			11.06
	°	'	"	°	'	"
Declination	- 23	33	22.44	-23	15	32.89
Hourly Motion		-5	14.32.			-7.89
Equatorial Horizontal Parallax		60	10.30			08.93
True Semi-diameter		16	23.40		16	14.49

CIRCUMSTANCES OF THE ECLIPSE										
	Universal Time			Indian Standard Time			Latitude		Longitude	
	d	h	m	d	h	m	°	'	°	'
Eclipse begins	14	13	34.0	14	19	04.0	-2	06.5	-115	40.8
Central eclipse begins	14	14	32.8	14	20	02.8	-7	46.0	-132	50.4
Greatest eclipse*	14	16	13.5	14	21	43.5	-40	20.2	-67	57.5
Central eclipse ends	14	17	54.1	14	23	24.1	-23	37.0	+11	02.9
Eclipse ends	14	18	53.0	15	00	23.0	-18	01.8	-06	28.2

*Magnitude of the eclipse = 1.0245, Maximum duration of total phase = 2 min 14s

TOTAL SOLAR ECLIPSE OF DECEMBER 14, 2020



The timings of beginning and ending are expressed in UT

ECLIPSES, 2020

BESSELIAN ELEMENTS OF THE TOTAL ECLIPSE OF THE SUN DECEMBER 14

Terrestrial Time (TT)		Co-ordinates of the Centre of Shadow on the Fundamental Plane		Direction of the Axis of Shadow *					Radius of Penumbra and Umbra on the Fundamental Plane	
h	m	x	y	sin d	cos d	μ °	'	"	l_1	l_2
13	00	-1.871460	-0.010551	-0.394772	+0.918779	16	16	34.8	+0.542564	-0.002457
	10	-1.777628	-0.025029	-0.394777	+0.918777	18	46	32.7	+0.542592	-0.002429
	20	-1.683790	-0.039498	-0.394783	+0.918775	21	16	30.6	+0.542620	-0.002402
	30	-1.589947	-0.053957	-0.394788	+0.918772	23	46	28.5	+0.542647	-0.002375
	40	-1.496100	-0.068407	-0.394793	+0.918770	26	16	26.4	+0.542673	-0.002349
	50	-1.402248	-0.082846	-0.394799	+0.918768	28	46	24.3	+0.542698	-0.002323
14	00	-1.308391	-0.097276	-0.394804	+0.918765	31	16	22.2	+0.542723	-0.002298
	10	-1.214531	-0.111696	-0.394810	+0.918763	33	46	20.1	+0.542747	-0.002274
	20	-1.120667	-0.126106	-0.394815	+0.918761	36	16	18.0	+0.542771	-0.002250
	30	-1.026799	-0.140506	-0.394820	+0.918758	38	46	15.9	+0.542794	-0.002228
	40	-0.932929	-0.154896	-0.394826	+0.918756	41	16	13.8	+0.542816	-0.002205
	50	-0.839055	-0.169275	-0.394831	+0.918754	43	46	11.7	+0.542837	-0.002184
15	00	-0.745178	-0.183645	-0.394836	+0.918751	46	16	09.6	+0.542858	-0.002163
	10	-0.651299	-0.198005	-0.394842	+0.918749	48	46	07.5	+0.542878	-0.002143
	20	-0.557418	-0.212354	-0.394847	+0.918747	51	16	05.4	+0.542898	-0.002123
	30	-0.463535	-0.226693	-0.394852	+0.918745	53	46	03.3	+0.542917	-0.002105
	40	-0.369650	-0.241022	-0.394858	+0.918742	56	16	01.2	+0.542935	-0.002086
	50	-0.275764	-0.255340	-0.394863	+0.918740	58	45	59.1	+0.542953	-0.002069
16	00	-0.181876	-0.269648	-0.394868	+0.918738	61	15	57.0	+0.542969	-0.002052
	10	-0.087988	-0.283946	-0.394873	+0.918736	63	45	54.9	+0.542986	-0.002036
	20	+0.005901	-0.298233	-0.394879	+0.918733	66	15	52.8	+0.543001	-0.002020
	30	+0.099791	-0.312509	-0.394884	+0.918731	68	45	50.7	+0.543016	-0.002005
	40	+0.193680	-0.326776	-0.394889	+0.918729	71	15	48.6	+0.543031	-0.001991
	50	+0.287570	-0.341031	-0.394895	+0.918726	73	45	46.5	+0.543044	-0.001977
17	00	+0.381459	-0.355276	-0.394900	+0.918724	76	15	44.4	+0.543057	-0.001964
	10	+0.475347	-0.369510	-0.394905	+0.918722	78	45	42.3	+0.543070	-0.001952
	20	+0.569235	-0.383733	-0.394910	+0.918720	81	15	40.2	+0.543081	-0.001940
	30	+0.663121	-0.397946	-0.394916	+0.918717	83	45	38.1	+0.543092	-0.001929
	40	+0.757006	-0.412148	-0.394921	+0.918715	86	15	36.0	+0.543103	-0.001918
	50	+0.850889	-0.426339	-0.394926	+0.918713	88	45	33.9	+0.543113	-0.001909
18	00	+0.944771	-0.440519	-0.394931	+0.918711	91	15	31.8	+0.543122	-0.001899
	10	+1.038650	-0.454688	-0.394937	+0.918708	93	45	29.7	+0.543131	-0.001891
	20	+1.132526	-0.468846	-0.394942	+0.918706	96	15	27.6	+0.543139	-0.001883
	30	+1.226400	-0.482994	-0.394947	+0.918704	98	45	25.5	+0.543146	-0.001875
	40	+1.320271	-0.497130	-0.394952	+0.918702	101	15	23.4	+0.543153	-0.001869
	50	+1.414139	-0.511255	-0.394957	+0.918700	103	45	21.3	+0.543159	-0.001863
19	00	+1.508003	-0.525368	-0.394963	+0.918697	106	15	19.2	+0.543164	-0.001857

tanf1= 0.00475784 tanf2= 0.00473417

TT hr	d °	'	"	Variations per minute x'	y'	μ' '	"
13	-23	15	06	+0.009 383	-0.001 448	15	00
14	-23	15	14	+0.009 386	-0.001 442	15	00
15	-23	15	21	+0.009 388	-0.001 436	15	00
16	-23	15	28	+0.009 389	-0.001 430	15	00
17	-23	15	35	+0.009 389	-0.001 423	15	00
18	-23	15	42	+0.009 388	-0.001 417	15	00

$\xi' = 0.004364\ \rho\cos\phi'\cos(\mu+\lambda)$ $\eta' = 0.004364\ \xi\sin d$

*d stands for declination and μ stands for hour angle

ECLIPSES, 2020

PATH OF CENTRAL PHASE DURING THE TOTAL ECLIPSE OF THE SUN
DECEMBER 14

Terrestrial Time (TT)	Northern Limit		Central Line		Southern Limit		Central Line
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Duration of totality
	° '	° '	° '	° '	° '	° '	m s
Limit	-7 37.3	-132 44.6	-7 46.0	-132 50.4	-7 54.7	-132 56.2	-------
h m							
14 40	-16 29.3	-114 59.1	-16 34.3	-115 21.3	-16 39.1	-115 43.6	0 53
50	21 33.0	-106 24.7	-21 42.3	-106 45.2	-21 51.4	-107 05.8	1 10
15 00	-25 17.4	-100 19.0	-25 29.5	-100 39.0	- 25 41.5	-100 59.0	1 23
10	28 21.8	95 13.9	28 36.2	95 33.2	28 50.4	95 52.7	1 34
20	30 59.2	90 39.1	31 15.5	90 57.7	31 31.7	91 16.4	1 43
30	33 15.7	86 20.1	33 33.7	86 37.5	33 51.6	86 55.1	1 51
40	35 14.4	82 08.0	35 33.9	82 23.9	35 53.3	82 40.0	1 57
50	36 56.9	77 57.0	37 17.7	78 11.0	37 38.4	78 25.2	2 01
16 00	-38 24.0	-73 42.9	-38 45.8	-73 54.6	-39 07.6	-74 06.5	2 04
10	39 35.9	69 22.5	39 58.5	69 31.5	40 21.1	69 40.7	2 06
20	40 32.2	64 53.2	40 55.3	64 59.2	41 18.4	65 05.3	2 05
30	41 12.3	60 12.9	41 35.5	60 15.6	41 58.7	60 18.3	2 03
40	41 35.1	55 19.5	41 58.1	55 18.7	42 21.0	55 17.8	2 00
50	41 39.0	50 10.8	42 01.3	50 06.4	42 23.6	50 01.8	1 55
17 00	-41 22.0	-44 43.8	-41 43.1	-44 35.8	-42 04.2	-44 27.7	1 48
10	40 40.8	38 53.9	41 00.3	38 42.6	41 19.7	38 31.1	1 39
20	39 30.6	32 33.0	39 47.9	32 18.7	40 05.1	32 04.2	1 29
30	37 42.7	25 25.0	37 57.1	25 08.1	38 11.4	24 51.0	1 17
40	34 57.8	16 51.1	35 08.3	16 31.8	35 18.7	16 12.4	1 02
50	30 05.8	-4 20.0	30 09.5	-3 56.3	30 12.9	-3 32.4	0 42
Limit	-23 29.3	+10 57.3	-23 36.8	+11 03.0	-23 44.4	+11 08.7	-------

ECLIPSES, 2020

PENUMBRAL ECLIPSE OF THE MOON, January 10, 2020, Friday

CIRCUMSTANCES OF THE ECLIPSE											
	Universal Time			Indian Standard Time			Position Angle from the North Point of Moon's Limb (N.E.S.W)**	The Moon being in the Zenith in			
								Latitude		Longitude	
	d	h	m	d	h	m	°	°	'	°	'
Moon enters penumbra	10	17	06.0	10	22	36.0	136	23	04	104	28
Middle of the eclipse*	10	19	10.2	11	00	40.2	-	22	58	75	18
Moon leaves penumbra	10	21	14.4	11	02	44.4	230	22	50	46	08

* Penumbral magnitude of eclipse : 0.921

** N.E.S.W stands for North, East, South and West

Note : - A penumbral eclipse of the Moon is not to be taken as an eclipse of the Moon in the ordinary sense, as the Moon is not covered by the real shadow of the Earth during such an eclipse.

ECLIPSES, 2020

PENUMBRAL ECLIPSE OF THE MOON, June 5, 2020, Friday

CIRCUMSTANCES OF THE ECLIPSE											
	Universal Time			Indian Standard Time			Position Angle from the North Point of Moon's Limb (N.E.S.W)**	The Moon being in the Zenith in			
								Latitude		Longitude	
	d	h	m	d	h	m	°	°	'	°	'
Moon enters penumbra	05	17	43.5	05	23	13.5	154	-21	15	93	22
Middle of the eclipse*	05	19	25.1	06	00	55.1	-	-21	34	69	35
Moon leaves penumbra	05	21	06.7	06	02	36.7	229	-21	52	45	49

* Penumbral magnitude of eclipse: 0.593

** N.E.S.W stands for North, East, South and West

Note : - A penumbral eclipse of the Moon is not to be taken as an eclipse of the Moon in the ordinary sense, as the Moon is not covered by the real shadow of the Earth during such an eclipse.

ECLIPSES, 2020

PENUMBRAL ECLIPSE OF THE MOON, July 5, 2020, Sunday

CIRCUMSTANCES OF THE ECLIPSE											
	Universal Time			Indian Standard Time			Position Angle from the North Point of Moon's Limb (N.E.S.W)**	The Moon being in the Zenith in			
								Latitude		Longitude	
	d	h	m	d	h	m	°	°	'	°	'
Moon enters penumbra	5	03	04.5	5	08	34.5	29	-24	04	-46	07
Middle of the eclipse*	5	04	30.0	5	10	00.0	-	-24	03	-65	25
Moon leaves penumbra	5	05	55.5	5	11	35.5	330	-24	00	-84	44

* Penumbral magnitude of eclipse: 0.380

** N.E.S.W stands for North, East, South and West

Note : - A penumbral eclipse of the Moon is not to be taken as an eclipse of the Moon in the ordinary sense, as the Moon is not covered by the real shadow of the Earth during such an eclipse.

ECLIPSES, 2020

PENUMBRAL ECLIPSE OF THE MOON, November 30, 2020. Monday

CIRCUMSTANCES OF THE ECLIPSE											
	Universal Time			Indian Standard Time			Position Angle from the North Point of Moon's Limb (N.E.S.W)**	The Moon being in the Zenith in			
								Latitude		Longitude	
	d	h	m	d	h	m	°	°	'	°	'
Moon enters penumbra	30	07	29.9	30	12	59.9	30	20	28	-115	47
Middle of the eclipse*	30	09	42.9	30	15	12.9	-	20	52	-147	26
Moon leaves penumbra	30	11	55.9	30	17	25.9	300	21	15	-179	05

* Penumbral magnitude of eclipse: 0.855

** N.E.S.W stands for North, East, South and West

Note: - A penumbral eclipse of the Moon is not to be taken as an eclipse of the Moon in the ordinary sense, as the Moon is not covered by the real shadow of the Earth during such an eclipse.

OCCULTATIONS, 2020

PLANETS BY THE MOON

Sl. No	Date and Ingress - Egress Times (U.T.)		Planet	Magnitude of Planet	Area of Visibility
		h -- h			
1.	Jan – 23	00.5 – 04.9	Jupiter	- 1.9	Madagascar, Kerguelen Islands, southern and eastern Australia, New Zealand, south and eastern Melanesia, south western Polynesia.
2.	Feb – 18	11.6 – 15.3	Mars	1.2	North America (except north western Canada and Alaska), most of Central America, Caribbean, northernmost South America, Southernmost tip of Greenland, Azores.
3.	Feb – 19	18.3 – 21.1	Jupiter	-1.9	Antarctica, southernmost South America.
4.	Feb – 20	06.3 – 09.8	Pluto	14.4	South easternmost South America, Antarctica, Kerguelen Islands, south westernmost tip of Australia.
5.	Mar – 18	06.6 – 10.3	Mars	0.9	Southernmost South America, South Georgia, Antarctica, Kerguelen Islands.
6.	Mar – 18	13.4 – 16.1	Pluto	14.3	Most of Antarctica.
7.	Apr – 14	21.5 – 22.2	Pluto	14.3	Part of Antarctic Peninsula.
8.	Jun – 19	06.8 – 10.3	Venus	-4.4	Azores, Canary Islands, north and eastern Canada, Greenland, north western half of Europe, northern and central Russia, northern Mongolia.
9.	Aug – 02	05.0 – 06.6	Pluto	14.3	Most of East Antarctica.
10.	Aug – 09	06.7 – 10.6	Mars	-1.3	Most of West Antarctica, south eastern South America, Ascension Island.
11.	Aug – 29	10.4 – 11.7	Pluto	14.3	Queen Maud Land, most of West Antarctica.
12.	Sep – 06	02.4 – 07.1	Mars	-1.9	Central and north eastern South America, Cape Verde Is., northern Africa, southernmost Europe.
13.	Oct – 03	02.2 – 05.9	Mars	-2.5	South and south easternmost South America, most of West Antarctica, Ascension Island, south western Africa.
14.	Dec – 12	19.3 – 23.0	Venus	-3.9	Easternmost Russia, Hawaii, western North America.

OCCULTATIONS, 2020

ELEMENTS OF OCCULTATIONS OF PLANETS

Sl. No.	T_0 (U.T. of Conj. in R.A.)			H_0		Y	x′	y′	Body Occulted					
									Right Ascension			Declination		
	d	h	m	h	m				h	m	s	°	′	″
1.	Jan – 23	02	41.1	-08	00.9	-0.3820	0.5623	-0.0029	18	50	53.6	-22	-51	-58.5
2.	Feb – 18	13	17.1	05	04.0	0.8008	0.5383	-0.0442	18	06	13.5	-23	-39	-42.8
3.	Feb – 19	19	35.7	10	17.4	-0.9986	0.5551	0.0230	19	16	15.5	-22	-16	-09.1
4.	Feb – 20	07	51.7	-01	52.3	-0.8065	0.5594	0.0502	19	44	05.9	-22	-01	-33.4
5.	Mar – 18	08	18.4	00	32.3	-0.7957	0.5304	0.0370	19	32	42.2	-22	-26	-48.3
6.	Mar – 18	14	33.8	06	34.5	-1.0209	0.5566	0.0544	19	46	50.7	-21	-57	-40.9
7.	Apr – 14	21	37.1	15	24.1	-1.2618	0.5610	0.0568	19	48	15.4	-21	-57	-15.8
8.	Jun – 19	08	54.0	22	28.7	0.8049	0.5588	0.1528	04	18	35.8	18	33	32.1
9.	Aug – 02	05	36.2	06	41.0	-1.1944	0.5767	0.0520	19	41	26.4	-22	-26	-05.1
10.	Aug – 09	08	00.1	27	48.3	-0.8369	0.4851	0.2160	01	26	02.8	04	43	33.8
11.	Aug – 29	10	50.8	13	45.2	-1.2269	0.5712	0.0508	19	39	10.0	-22	-33	-36.9
12.	Sep – 06	04	46.1	25	60.0	0.0297	0.5022	0.2174	01	50	17.6	06	47	54.0
13.	Oct – 03	03	25.7	02	40.2	-0.8065	0.5175	0.2272	01	35	54.0	06	06	44.8
14.	Dec – 12	20	39.8	10	31.0	0.7851	0.5343	-0.1789	15	38	00.7	-18	-02	-40.0

OCCULTATIONS, 2020
ELEMENTS (contd.)

Sl. No.	l	a
1.	0.2726	1.00
2.	0.2729	1.00
3.	0.2726	1.00
4.	0.2725	1.00
5.	0.2730	1.00
6.	0.2725	1.00
7.	0.2725	1.00
8.	0.2747	1.00
9.	0.2725	1.00
10.	0.2737	1.00
11.	0.2725	1.00
12.	0.2741	1.00
13.	0.2743	1.00
14.	0.2729	1.00

PART - V

ASTRONOMICAL PHENOMENA
AND
MISCELLANEOUS TABLES

PHENOMENA, 2020

ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h U.T.

Date		Mercury			Venus			Date		Mercury			Venus		
		Elong.		Mag.	Elong.		Mag.			Elong.		Mag.	Elong.		Mag.
			°			°					°			°	
Jan.	-3	W.	8	-0.8	E.	34	-3.9	June	30	E.	5	…	E.	33	-4.7
	2		5	-1.0		35	-4.0	July	5		8	+4.7		37	-4.7
	7		3	-1.2		36	-4.0		10		13	+2.9		39	-4.7
	12		2	-1.4	E.	37	-4.0		15		18	+1.6		41	-4.7
	17		5	-1.3		38	-4.0		20		20	+0.6		43	-4.6
	22	W.	8	-1.1	E.	39	-4.1		25	E.	20	-0.1	E.	44	-4.6
	27		11	-1.1		39	-4.1		30		18	-0.7		45	-4.6
Feb.	1		14	-1.0		40	-4.1	Aug.	4		14	-1.1		45	-4.5
	6		17	-0.9		41	-4.1		9	W.	9	-1.4		46	-4.5
	11		18	-0.6		42	-4.2		14		4	-1.8		46	-4.4
	16	W.	16	+0.4	E.	43	-4.2		19	W.	2	-1.9	E.	46	-4.4
	21	E.	10	+2.6		43	-4.2		24		6	-1.3		45	-4.3
	26		4	…		44	-4.3		29		11	-0.8		45	-4.3
Mar.	2		11	+3.3		45	-4.3	Sept.	3		14	-0.5		45	-4.3
	7		18	+1.6		45	-4.3		8		18	-0.3		44	-4.2
	12	E.	24	+0.8	E.	46	-4.4		13	W.	20	-0.2	E.	43	-4.2
	17		26	+0.4		46	-4.4		18		23	-0.1		43	-4.2
	22		28	+0.2		46	-4.5		23	E.	24	-0.1		42	-4.1
	27		28	+0.1		46	-4.5		28		26	+0.0		41	-4.1
Apr.	1	W.	27	0		46	-4.6	Oct.	3		26	+0.0		40	-4.1
	6	W.	25	-0.1	E.	46	-4.6		8	E.	25	+0.1	E.	39	-4.1
	11		22	-0.2		45	-4.6		13		22	+0.4		38	-4.0
	16		19	-0.4		44	-4.7		18		16	+1.5		37	-4.0
	21		15	-0.7		43	-4.7		23		6	+4.1		36	-4.0
	26		10	-1.1		41	-4.7		28		5	+4.5	W.	35	-4.0
May	1	W.	5	-1.8	E.	38	-4.7	Nov.	2	E.	14	+1.1	W.	34	-4.0
	6		1	-2.3		35	-4.7		7		18	-0.3		33	-4.0
	11		7	-1.6		31	-4.7		12		19	-0.7		32	-3.9
	16		13	-1.1		26	-4.6		17		18	-0.7		31	-3.9
	21		18	-0.7		20	-4.4		22		15	-0.7		30	-3.9
	26	W.	21	-0.4	E.	14	-4.1		27	W.	13	-0.7	W.	29	-3.9
	31		23	+0.0		6	…	Dec.	2		10	-0.8		27	-3.9
June	5		24	+0.5		2	…		7		7	-0.9		26	-3.9
	10	E.	23	+1.0		10	-4.1		12		5	-1.0		25	-3.9
	15		20	+1.7		17	-4.2		17		2	-1.2		24	-3.9
	20	E.	16	+2.7	E.	23	-4.4		22	W.	2	-1.3	W.	23	-3.9
	25		10	+4.1		29	-4.6		27		4	-1.1		22	-3.9
	30	E.	5	…	E.	33	-4.7		32	W.	7	-1.0	W.	20	-3.9

Conjunction-	Mercury (d h)		Venus (d h)	Mercury (d h)		Venus (d h)
Superior:	Jan. 10 15	May 4 22	…	Aug. 17 15	Dec. 20 03	…
Inferior:	Feb. 26 02	Jul. 1 03	Jun. 3 18	Oct. 25 18	…	…

N.B.- E. means that the planet is in the east of the Sun and W. means that it is in the west of the Sun by the amount of the arc stated.

PHENOMENA, 2020

ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h UT

Date		Mars		Jupiter		Saturn		Uranus	Neptune	Pluto
		Elong. °	Mag.	Elong. °	Mag.	Elong. °	Mag.	Elong. °	Elong. °	Elong. °
Jan.	-8	W. 38	+1.6	W. 4	-1.8	W. 20	+0.5	E. 122	E. 75	E. 21
	2	42	+1.6	4	-1.8	10	+0.5	112	65	11
	12	45	+1.5	12	-1.8	1	+0.5	101	55	W. 2
	22	49	+1.4	20	-1.9	8	+0.6	91	45	8
Feb.	1	52	+1.4	28	-1.9	17	+0.6	81	36	18
	11	W. 55	+1.3	W. 36	-1.9	W. 26	+0.6	E. 71	E. 26	W. 28
	21	59	+1.2	44	-1.9	35	+0.7	62	16	38
Mar.	2	62	+1.1	52	-2.0	44	+0.7	52	6	48
	12	65	+1.0	60	-2.0	53	+0.7	42	W. 3	57
	22	68	+0.9	69	-2.1	62	+0.7	33	13	67
Apr.	1	W. 71	+0.8	W. 77	-2.1	W. 71	+0.7	E. 23	W. 22	W. 77
	11	74	+0.7	86	-2.2	80	+0.6	14	32	87
	21	77	+0.5	95	-2.3	90	+0.6	W. 5	41	96
May	1	79	+0.4	104	-2.3	99	+0.6	4	51	106
	11	82	+0.3	E. 114	-2.4	109	+0.5	13	60	116
	21	W. 85	+0.1	E. 123	-2.5	W. 119	+0.5	W. 22	W. 70	W. 126
	31	88	+0.0	133	-2.6	128	+0.4	32	79	135
June	10	91	-0.2	143	-2.6	138	+0.4	41	89	145
	20	94	-0.3	154	-2.7	148	+0.3	50	98	155
	30	98	-0.5	165	-2.7	E. 159	+0.2	59	108	165
July	10	W. 101	-0.7	E. 175	-2.7	E. 169	+0.2	W. 68	W. 117	W. 174
	20	105	-0.8	174	-2.7	179	+0.1	77	127	E. 176
	30	E. 110	-1.0	163	-2.7	171	+0.1	87	137	166
Aug.	9	115	-1.3	152	-2.7	160	+0.2	96	146	156
	19	122	-1.5	142	-2.6	150	+0.2	106	156	146
	29	E. 129	-1.7	E. 132	-2.6	E. 140	+0.3	W. 116	W. 166	E. 137
Sept.	8	138	-2.0	122	-2.5	130	+0.3	125	E. 176	127
	18	148	-2.2	112	-2.4	120	+0.4	135	174	117
	28	159	-2.4	102	-2.4	110	+0.4	145	164	107
Oct.	8	171	-2.6	93	-2.3	100	+0.5	156	154	97
	18	E. 174	-2.6	E. 84	-2.3	E. 91	+0.5	W. 166	E. 144	E. 87
	28	162	-2.3	75	-2.2	81	+0.6	E. 176	133	78
Nov.	7	151	-1.9	67	-2.1	72	+0.6	173	123	68
	17	140	-1.6	58	-2.1	62	+0.6	163	113	58
	27	131	-1.3	W. 50	-2.0	53	+0.6	152	103	48
Dec.	7	E. 123	-1.0	W. 42	-2.0	E. 44	+0.6	E. 142	E. 93	E. 38
	17	116	-0.7	34	-2.0	34	+0.6	132	83	28
	27	110	-0.4	26	-2.0	25	+0.6	121	73	18
	37	E. 104	-0.1	W. 18	-2.0	W. 16	+0.6	E. 111	E. 63	E. 9
		d h		d h		d h		d h	d h	d h
Conjunction:		….		Dec. 27 18		Jan. 13 15		Apr. 26 09	Mar. 8 12	Jan. 13 13
Opposition:		Oct. 13 23		Jul. 14 08		Jul. 20 22		Oct. 31 16	Sept.11 20	July 15 19

Magnitudes at opposition: Uranus +5.7; Neptune +7.8; Pluto +14.5

N.B. - E. means that the planet is in the east of the Sun and W. means that it is in the west of the Sun by the amount of the arc stated.

PHENOMENA, 2020

CONJUNCTIONS, OPPOSITIONS ETC. OF PLANETS WITH THE SUN (IN LONGTITUDE)

UNIVERSAL TIME

MERCURY

		d	h	m			d	h	m	
Superior conjunction	Jan.	10	15	17		Aug.	17	15	10	
Heliacal rising E.	Jan.	26	00	02		Sept.	2	03	29	
Greatest elongation E.	Feb.	10	13	56	(18˚.2)	Oct.	1	16	06	(25˚.8)
Retrograde	Feb.	17	00	54		Oct.	14	00	50	
Heliacal setting E.	Feb.	20	21	07		Oct.	17	08	41	
Inferior conjunction	Feb.	26	01	44		Oct.	25	18	23	
Heliacal rising W.	Mar.	2	11	47		Oct.	30	13	16	
Direct	Mar.	10	03	58		Nov.	3	17	58	
Greatest elongation W.	Mar.	24	02	06	(27˚.8)	Nov.	10	17	03	(19˚.1)
Heliacal setting W.	Apr.	18	05	49		Dec.	1	17	23	
Superior conjunction	May	4	21	41		Dec.	20	03	25	
Heliacal rising E.	May	13	08	32			…	…	…	
Greatest elongation E.	June	4	13	07	(23˚.6)		…	…	…	
Retrograde	June	18	05	01			…	…	…	
Heliacal setting E.	June	22	01	24			…	…	…	
Inferior conjunction	July	1	02	53			…	…	…	
Heliacal rising W.	July	10	04	26			…	…	…	
Direct	July	12	08	22			…	…	…	
Greatest elongation W.	July	22	15	12	(20˚.1)		…	…	…	
Heliacal setting W.	Aug.	8	09	17			…	…	…	

VENUS

		d	h	m		d	h	m
Superior conjunction		…	…	…		…	…	…
Heliacal rising E.		…	…	…		…	…	…
Greatest elongation E.	Mar.	24	22	13	(46˚.1)	…	…	…
Retrograde	May	13	06	42		…	…	…
Heliacal setting E.	May	31	00	12		…	…	…
Inferior conjunction	June	3	17	44		…	…	…
Heliacal rising W.	June	8	13	52		…	…	…
Direct	June	25	06	51		…	…	…
Greatest elongation W.	Aug.	13	00	14	(45˚.8)	…	…	…
Heliacal setting W.		…	…	…		…	…	…

EARTH

		d	h	m			d	h	m		d	h	m
Perihelion	Jan.	5	07	37	Equinoxes	Mar.	20	03	50	Sept.	22	13	31
Aphelion	July	4	11	17	Solstices	June	20	21	44	Dec.	21	10	02

SUPERIOR PLANETS

	MARS				JUPITER				SATURN			
		d	h	m		d	h	m		d	h	m
Conjunction		…	…	…	Dec.	27	18	25	Jan.	13	15	16
Heliacal rising W.		…	…	…	Jan.	9	01	03	Jan.	30	00	21
Retrograde	Sept.	9	22	21	May	14	14	31	May	11	04	09
Opposition	Oct.	13	23	26	July	14	07	59	July	20	22	28
Direct	Nov.	14	00	36	Sept.	13	00	41	Sept.	29	05	12
Heliacal setting E.		…	…	…		…	…	…		…	…	…

PHENOMENA, 2020

CONJUNCTIONS, OPPOSITIONS ETC. OF PLANETS WITH THE SUN (IN LONGITUDE)

UNIVERSAL TIME

SUPERIOR PLANETS

	URANUS				NEPTUNE				PLUTO			
		d	h	m		d	h	m		d	h	m
Conjunction	Apr.	26	09	01	Mar.	8	12	24	Jan.	13	13	17
Retrograde	Aug.	15	14	26	June	23	04	31	Apr.	25	18	52
Opposition	Oct.	31	15	53	Sept.	11	20	26	July	15	19	09
Direct	Jan.	11	01	48	Nov.	29	00	37	Oct.	4	13	33

N.B.- The heliacal risings and settings have been calcuted for 23° 11' north latitude. Here E. means east of the Sun or the western horizon and W. means west of the Sun or the eastern horizon.

PHENOMENA, 2020

CONJUNCTION OF PLANETS WITH THE MOON AND OTHER PLANETS (IN LONGITUDE)

UNIVERSAL TIME

	d	h	m			d	h	m	
Jan.	2	16	42	*Mercury conj. Jupiter*	May	12	10	30	Moon conj. Jupiter
	12	09	51	*Mercury* conj. *Saturn*		12	19	18	Moon conj. Saturn
	20	19	47	Moon conj. Mars		15	04	06	Moon conj. Mars
	23	02	45	Moon conj. Jupiter		22	08	41	*Mercury conj. Venus*
	24	02	08	Moon conj. Saturn		24	03	15	Moon conj. Venus
	25	19	07	Moon conj. Mercury		24	11	09	Moon conj. Mercury
	28	11	02	Moon conj. Venus	June	8	18	06	Moon conj. Jupiter
Feb.	18	13	17	Moon conj. Mars		9	03	17	Moon conj. Saturn
	19	19	50	Moon conj. Jupiter		13	02	13	Moon conj. Mars
	20	14	18	Moon conj. Saturn		19	08	40	Moon conj. Venus
	24	00	39	Moon conj. Mercury		22	08	01	Moon conj. Mercury
	27	17	06	Moon conj. Venus	July	5	22	13	Moon conj. Jupiter
Mar.	18	08	33	Moon conj. Mars		6	09	35	Moon conj. Saturn
	18	10	48	Moon conj. Jupiter		11	21	16	Moon conj. Mars
	19	00	48	Moon conj. Saturn		17	06	41	Moon conj. Venus
	20	11	35	*Mars conj. Jupiter*		19	04	19	Moon conj. Mercury
	21	20	39	Moon conj. Mercury	Aug.	1	23	57	Moon conj. Jupiter
	28	14	21	Moon conj. Venus		2	13	59	Moon conj. Saturn
	31	18	31	*Mars* conj. *Saturn*		9	08	36	Moon conj. Mars
Apr.	14	23	47	Moon conj. Jupiter		15	13	27	Moon conj. Venus
	15	10	21	Moon conj. Saturn		19	05	38	Moon conj. Mercury
	16	05	42	Moon conj. Mars		29	01	56	Moon conj. Jupiter
	21	20	06	Moon conj. Mercury		29	17	18	Moon conj. Saturn
	26	16	39	Moon conj. Venus	Sept.	6	04	45	Moon conj. Mars

PHENOMENA, 2020 --- *contd.*

CONJUNCTION OF PLANETS WITH THE MOON AND OTHER PLANETS (IN LONGITUDE)

UNIVERSAL TIME

	d	h	m			d	h	m	
Sept.	14	06	53	Moon conj. Venus	Nov.	12	23	31	Moon conj. Venus
	19	02	08	Moon conj. Mercury		13	21	44	Moon conj. Mercury
	25	07	12	Moon conj. Jupiter		19	09	43	Moon conj. Jupiter
	25	21	26	Moon conj. Saturn		19	15	51	Moon conj. Saturn
Oct.	3	03	57	Moon conj. Mars		25	23	39	Moon conj. Mars
	14	02	55	Moon conj. Venus	Dec.	12	20	59	Moon conj. Venus
	17	21	52	Moon conj. Mercury		14	10	41	Moon conj. Mercury
	22	17	44	Moon conj. Jupiter		17	05	34	Moon conj. Jupiter
	23	04	35	Moon conj. Saturn		17	06	28	Moon conj. Saturn
	29	18	33	Moon conj. Mars		21	18	21	*Jupiter conj. Saturn*
						23	22	51	Moon conj. Mars

CONJUNCTIONS OF PLANETS WITH BRIGHT STARS (IN R.A.)

	d	h	m			d	h	m	
Jan.	17	04	05	Mars 4˚.82 N. of *Antares*	Sept.	1	16	57	Venus 8˚.68 S. of *Pollux*
Apr.	17	19	48	Venus 10˚.13 N. of *Aldebaran*	Sept.	22	08	52	Mercury 0˚.30 N. of *Spica*
May	17	08	52	Mercury 7˚.36 N. of *Aldebaran*	Oct.	3	23	41	Venus 0˚.09 S. of *Regulus*
June	8	08	20	Venus 4˚.92 N. of *Aldebaran*	Nov.	15	13	23	Venus 4˚.13 N. of *Spica*
July	12	06	39	Venus 0˚.96 N. of *Aldebaran*	Dec.	7	20	00	Mercury 4˚.39 N. of *Antares*
Aug.	2	05	30	Mercury 6˚.64 S. of *Pollux*	Dec.	23	00	48	Venus 5˚.65 N. of *Antares*
Aug.	19	20	56	Mercury 1˚.36 N. of *Regulus*					

ASTRONOMICAL DIARY, 2020

UNIVERSAL TIME

	d	h	m	
Jan.	2	1	30	Moon at apogee
	2	10	27	Moon greatest lat. S 5° 16'
	2	15	16	Mercury 1.5° S of Jupiter
	3	04	45	FIRST QUARTER
	4	18	22	Uranus 4.7° N of Moon
	5	07	37	Earth at Perihelion
	9	23	29	Moon in ascending node
	10	15	17	Mercury in superior conjunction
				1° 56' S of Sun
	10	19	21	FULL MOON
				Penumbral Lunar Eclipse
	11	07	22	Uranus stationary in RA
	12	04	31	Mercury 2.1° S of Saturn
	13	13	17	Pluto in conjunction with Sun
	13	15	16	Saturn in conjunction with Sun
	13	20	20	Moon at perigee
	15	14	50	Moon greatest lat. N 5°12'
	17	04	05	Mars 4.8° N. of *Antares*
	17	12	58	LAST QUARTER
	19	11	36	Mercury greatest helio lat. S.
	20	19	12	Mars 2.3° S of Moon
	22	20	32	Moon in descending node
	23	02	41	Jupiter 0.4° N of Moon
				Occultation
	23	06	54	Uranus in square with Sun
	24	21	42	NEW MOON
	24	01	39	Saturn 1.5° N of Moon
	25	18	13	Mercury 1.3° N of Moon
	27	19	25	Venus 0.1° S of Neptune
	28	06	20	Neptune 4.1° N of Moon
	28	07	28	Venus 4.1 ° N of Moon
	29	13	55	Moon greatest lat. S 5° 10'
	29	21	27	Moon at apogee
Feb.	1	03	01	Uranus 4.6° N of Moon
	1	16	60	Mars in descending node
	2	01	42	FIRST QUARTER
	6	08	58	Moon in ascending node
	7	13	02	Mercury in ascending node
	9	07	33	FULL MOON
	10	13	56	Mercury greatest elong. E. (18.2°)
	10	20	27	Moon at perigee
	11	17	47	Moon greatest lat. N 5°03'
	12	05	05	Mercury at perihelion
	12	15	37	Saturn in descending node
	15	05	33	Venus in ascending node
	15	22	17	LAST QUARTER
	16	10	15	Mercury stationary in RA
	18	13	17	Mars 0.8° S of Moon
				Occultation
	19	00	12	Moon in descending node
Feb.	19	19	36	Jupiter 0.9° N of Moon
				Occultation
	20	13	39	*Saturn 1.8* ° N of Moon
	22	10	17	Mercury greatest helio lat. N.
	23	15	32	NEW MOON
	23	18	43	Mercury 8.6° N of Moon
	24	15	14	Neptune 4.1° N of Moon
	25	15	46	Moon greatest lat. S 5° 00'
	25	15	56	Jupiter in descending node
	26	01	44	Mercury in inferior conjunction
				3° 43' N of Sun
	26	11	34	Moon at apogee
	27	11	52	Venus 6.3°N of Moon
	28	11	51	Uranus 4.3° N of Moon
Mar.	2	19	57	FIRST QUARTER
	4	14	59	Moon in ascending node
	8	12	24	Neptune in conjunction with Sun
	9	08	11	Mercury stationary in RA
	9	14	33	Venus 2.4°N. of Uranus
	9	17	48	FULL MOON
	10	06	28	Moon at perigee
	10	09	06	Moon greatest lat. N 4°57'
	16	09	34	LAST QUARTER
	16	19	58	Mercury in descending node
	17	01	00	Moon in descending node
	18	08	18	Mars 0.7° N of Moon
				Occultation
	18	10	18	*Jupiter 1.5* ° N of Moon
	18	23	56	*Saturn 2.1* ° N of Moon
	20	02	08	Venus at perihelion
	20	03	50	*Vernal Equinox*
	20	06	22	*Mars 0.7* ° S of Jupiter
	21	17	48	*Mercury 3.6* ° N of Moon
	22	23	23	Neptune 4.1° N of Moon
	23	16	12	Moon greatest lat. S 4° 56'
	24	02	06	Mercury greatest elong. W. (27.8°)
	24	09	28	NEW MOON
	24	15	24	Moon at apogee
	24	22	13	Venus greatest elong. E. (46.1°)
	26	20	42	Uranus 4.1° N of Moon
	27	04	43	Mercury at aphelion
	28	10	39	Venus 6.8° N of Moon
	30	09	31	Venus 1.9° N of Moon
	31	16	52	Moon in ascending node
	31	10	58	Mars 0.9° S of Saturn
Apr.	1	10	21	FIRST QUARTER
	3	15	13	Mercury 1.4° S of Neptune.
	6	12	20	Moon greatest lat. N 5°01'
	7	18	07	Moon at perigee
	8	02	35	FULL MOON

ASTRONOMICAL DIARY, 2020

UNIVERSAL TIME

	d	h	m			d	h	m	
Apr.	10	17	40	Venus greatest helio lat. N.	May	30	03	30	FIRST QUARTER
	13	02	59	Moon in descending node		31	06	38	Moon greatest lat. N 5˚10'
	14	11	03	Pluto in square with Sun	Jun.	3	03	28	Moon at perigee
	14	22	56	LAST QUARTER		3	17	44	Venus in inferior conjunction
	14	23	05	Jupiter 2.0° N of Moon					0˚ 29' N of Sun
	15	09	18	Saturn 2.5° N of Moon		4	13	07	Mercury greatest elong. E. (23.6˚)
	15	10	58	Jupiter in square with Sun		5	19	06	Venus in descending node
	16	04	33	Mars 2.0° N of Moon		5	19	12	FULL MOON
	16	10	49	Mercury greatest helio lat. S.					*Penumbral Lunar Eclipse*
	17	19	48	Venus 10.1˚ N. of *Aldebaran*		6	18	11	Moon in descending node
	19	07	09	Neptune 4.2˚ N of Moon		6	19	11	Mars in square with Sun
	19	16	38	Moon greatest lat. S 5˚ 00'		8	08	20	Venus 5.0˚ N. of *Aldebaran*
	20	19	00	Moon at apogee		8	17	21	Jupiter 2.2° N of Moon
	21	07	00	Saturn in square with Sun		9	02	12	Saturn 2.7° N of Moon
	21	17	16	Mercury 3.1° N of Moon		11	09	38	Neptune in square with Sun
	23	02	26	NEW MOON		12	23	18	Neptune 4.5˚ N of Moon
	23	05	51	Uranus 4.0° N of Moon		12	23	55	Mars 2.8° N of Moon
	26	09	01	Uranus in conjunction with Sun		12	12	24	Mars 1.7˚ S. of Neptune
	26	12	58	Pluto stationary in RA		12	19	08	Mercury in descending node
	26	15	25	Venus 6.1° N of Moon		13	06	24	LAST QUARTER
	27	17	55	Moon in ascending node		13	09	42	Moon greatest lat. S 5˚ 15'
	30	20	38	FIRST QUARTER		15	00	57	Moon at apogee
May	1	02	24	Mercury 0.3° S of Uranus		17	01	48	Uranus 3.9° N of Moon
	3	15	33	Moon greatest lat. N 5˚04'		17	19	35	Mercury stationary in RA
	4	21	41	Mercury in superior conjunction		19	08	54	Venus 0.7˚ S of Moon
				0˚ 06' S of Sun					*Occultation*
	5	12	22	Mercury in ascending node		20	21	44	*Summer solstice*
	6	03	02	Moon at perigee		21	04	23	Moon in ascending node
	7	10	45	FULL MOON		21	06	41	NEW MOON, *Solar Eclipse*
	7	10	53	Mars 7.3˚ N of Moon		22	07	18	Mercury 3.9° N of Moon
	10	04	20	Mercury at perihelion		23	03	58	Mercury at aphelion
	10	09	02	Moon in descending node		23	18	25	Neptune stationary in RA
	11	09	26	Saturn stationary in RA		24	18	11	Venus stationary in RA
	12	09	41	Jupiter 2.3° N of Moon		27	09	20	Moon greatest lat. N 5˚13'
	12	18	11	Saturn 2.7° N of Moon		28	08	16	FIRST QUARTER
	13	10	15	Venus stationary in RA		30	02	15	Moon at perigee
	14	14	03	LAST QUARTER	July	1	02	53	Mercury in inferior conjunction
	14	18	27	Jupiter stationary in RA					4˚ 27' S of Sun
	15	02	01	Mars 2.8° N of Moon		4	03	18	Moon in descending node
	16	15	03	Neptune 4.4˚ N of Moon		4	11	17	Earth at Aphelion
	17	06	24	Moon greatest lat. S 5˚ 08'		5	04	44	FULL MOON
	17	08	52	Mercury 7.4˚ N. of *Aldebaran*					*Penumbral Lunar Eclipse*
	18	07	44	Moon at apogee		5	21	39	*Jupiter 1.9° N of Moon*
	20	09	34	Mercury greatest helio lat. N.		6	08	38	*Saturn 2.5° N of Moon*
	20	15	35	Uranus 3.9° N of Moon		8	01	19	Mars greatest helio lat. S.
	22	07	56	Mercury 0.9˚ S. of Venus		10	07	28	Neptune 4.4˚ N of Moon
	22	17	39	NEW MOON		10	13	32	Moon greatest lat. S 5˚ 13'
	24	02	42	Venus 3.7° N of Moon		10	14	35	Venus at aphelion
	24	10	52	Mercury 2.8° N of Moon		11	19	38	Mars 2.0° N of Moon
	24	21	35	Moon in ascending node		12	06	39	Venus 1.0˚ N. of *Aldebaran*

ASTRONOMICAL DIARY, 2020

UNIVERSAL TIME

	d	h	m			d	h	m	
July	12	06	50	Mercury stationary in RA	Sept.	1	16	57	Venus 8.7° S. of *Pollux*
	12	19	26	Moon at apogee		2	05	22	FULL MOON
	12	23	29	LAST QUARTER		2	20	55	Neptune 4.2° N of Moon
	13	10	02	Mercury greatest helio lat. S.		3	06	08	Moon greatest lat. S 4° 57'
	14	07	59	Jupiter in opposition with Sun		6	04	46	*Mars 0.03° N of Moon*
	14	11	52	Uranus 3.8° N of Moon					*Occultation*
	15	19	09	Pluto in opposition with Sun		6	06	29	Moon at apogee
	17	07	26	Venus 3.1° S of Moon		7	03	54	Uranus 3.3° N of Moon
	18	12	33	Moon in ascending node		8	18	27	Mercury in descending node
	19	03	54	Mercury 3.9° S of Moon					
						9	17	46	Mars stationary in RA
	20	17	33	NEW MOON		10	09	26	LAST QUARTER
	20	22	28	Saturn in opposition with Sun		10	23	06	Moon in ascending node
	22	09	00	Saturn 0.0° S of Moon		11	20	26	Neptune in opposition with Sun
	22	15	12	Mercury greatest elong. W. (20.1°)		12	23	55	Jupiter stationary in RA
	24	11	49	Moon greatest lat. N 5°11'		14	04	43	Venus 4.5° S of Moon
	25	05	00	Moon at perigee		16	17	04	Moon greatest lat. N 4°55'
	27	12	33	FIRST QUARTER		17	11	00	NEW MOON
	31	09	32	Moon in descending node		18	06	23	Uranus 0.4° N of Moon
Aug.	1	11	45	Mercury in ascending node					
	1	15	31	Venus greatest helio lat. S.		18	13	47	Moon at perigee
						18	21	53	Mercury 6.4° S of Moon
	1	23	33	Jupiter 1.5° N of Moon		19	03	15	Mercury at aphelion
	2	05	30	Mercury 6.6° S. of *Pollux*		22	08	52	Mercury 0.3° N. of *Spica*
	2	11	18	Uranus in square with Sun		22	13	31	*Autumnal Equinox*
	2	13	10	Saturn 2.3° N of Moon		23	12	33	Moon in descending node
	3	09	00	Mars at perihelion		24	01	55	FIRST QUARTER
	3	15	59	FULL MOON		25	06	48	Jupiter 1.6° N of Moon
	6	03	37	Mercury at perihelion		25	20	38	Saturn 2.3° N of Moon
	6	14	51	Neptune 4.3° N of Moon					
	6	16	35	Moon greatest lat. S 5° 04'		26	17	51	Venus 7.8° S of Moon
	9	08	00	Mars 0.8° N of Moon		26	22	30	Venus in ascending node
				Occultation		29	02	52	Saturn stationary in RA
						30	01	44	Neptune 4.2° N of Moon
	9	13	49	Moon at apogee		30	06	39	Moon greatest lat. S 4° 57'
	10	20	51	Uranus 3.5° N of Moon	Oct.	1	16	06	Mercury greatest elong. E. (25.8°)
	11	16	45	LAST QUARTER		1	21	05	FULL MOON
	13	00	14	Venus greatest elong. W. (45.8°)		3	03	26	Mars 0.7° N of Moon
	14	19	24	Moon in ascending node					*Occultation*
	15	13	00	Venus 4.0° S of Moon					
	15	16	53	Uranus stationary in RA		3	17	22	Moon at apogee
	16	08	51	Mercury greatest helio lat. N.		3	23	41	Venus 0.1° S. of *Regulus*
	17	15	10	Mercury in superior conjunction		4	05	42	Pluto stationary in RA
				1° 46' N of Sun		4	08	57	Uranus 3.2° N of Moon
						6	14	17	Mars nearest to Earth
	19	02	42	NEW MOON		8	00	30	Moon in ascending node
	19	03	46	Mercury 2.8° N of Moon		9	09	16	Mercury greatest helio lat. S.
	19	20	56	Mercury 1.4° N. of *Regulus*		10	00	40	LAST QUARTER
	20	14	16	Moon greatest lat. N 5°01'		11	13	35	Jupiter in square with Sun
	21	10	56	Moon at perigee					
	25	17	58	FIRST QUARTER		13	23	26	Mars in opposition with Sun
	27	11	53	Moon in descending node		13	23	56	Venus 4.4° S of Moon
	29	01	36	Jupiter 1.4° N of Moon		14	04	18	Mercury stationary in RA
	29	16	32	Saturn 2.2° N of Moon		14	08	22	Moon greatest lat. N 5°00'

ASTRONOMICAL DIARY, 2020

UNIVERSAL TIME

	d	h	m			d	h	m	
Oct.	15	10	12	Pluto in square with Sun	Nov.	22	04	45	FIRST QUARTER
	16	19	31	NEW MOON		23	12	01	Neptune 4.5° N of Moon
	16	23	47	Moon at perigee		23	09	45	Moon greatest lat. S 5° 14'
	17	18	36	Mercury 6.8° S of Moon		25	19	47	Mars 4.9° N of Moon
	18	13	58	Saturn in square with Sun		27	24	28	Moon at apogee
	20	15	55	Moon in descending node		27	16	59	Uranus 3.3° N of Moon
	22	17	12	Jupiter 2.0° N of Moon		29	09	02	Neptune stationary in RA
	23	03	42	Saturn 2.6° N of Moon		30	09	30	FULL MOON
	23	13	23	FIRST QUARTER					*Penumbral Lunar Eclipse*
	25	18	23	Mercury in inferior conjunction	Dec.	1	07	46	Moon in ascending node
				0° 55' S of Sun		2	03	28	Mars in ascending node
	27	06	16	Neptune 4.4° N of Moon		5	17	41	Mercury in descending node
	27	07	28	Moon greatest lat. S 5° 04'		7	15	17	Moon greatest lat. N 5°14'
	28	11	03	Mercury in ascending node		7	20	00	Mercury 4.4° N of Antares.
	29	16	17	Mars 3.0° N of Moon		8	00	37	LAST QUARTER
	30	18	45	Moon at apogee		9	19	41	Neptune in square with Sun
	30	23	03	Venus at perihelion		12	20	40	Venus 0.8° S of Moon
	31	12	50	Uranus 3.2° N of Moon					*Occultation*
	31	14	49	FULL MOON		12	20	41	Moon at perigee
	31	15	53	Uranus in opposition with Sun		14	10	33	Mercury 1.0° S of Moon
Nov.	2	02	53	Mercury at perihelion		14	11	03	Moon in descending node
	3	08	25	Mercury stationary in RA		14	16	17	NEW MOON, *Solar Eclipse*
	4	02	40	Moon in ascending node		16	02	31	Mercury at aphelion
	8	13	46	LAST QUARTER		17	04	29	Jupiter 2.9° N of Moon
	10	11	55	Moon greatest lat. N 5°13'		17	05	19	Saturn 3.1° N of Moon
	10	17	03	Mercury greatest elong. W. (19.1°)		20	03	25	Mercury in superior conjunction
	12	08	08	Mercury greatest helio lat. N.					1° 27' S of Sun
	12	21	30	Venus 3.1° S of Moon		20	20	05	Neptune 4.6° N of Moon
	13	20	44	Mercury 1.7° S of Moon		20	13	26	Moon greatest lat. S 5° 16'
	14	11	43	Moon at perigee		21	10	02	*Winter solstice*
	15	05	07	NEW MOON		21	13	31	*Jupiter 0.1° S of Saturn*
	15	13	23	Venus 4.1° N. of *Spica*		21	23	41	FIRST QUARTER
	15	19	25	Mars stationary in RA		23	00	48	Venus 5.7° N. of *Antares*
	17	00	07	Moon in descending node		23	18	32	Mars 5.6° N of Moon
	19	08	56	Jupiter 2.5° N of Moon		24	16	30	Moon at apogee
	19	14	51	Saturn 2.9° N of Moon		24	22	40	Uranus 3.4° N of Moon
	21	10	31	Venus greatest helio lat. N.		28	15	03	Moon in ascending node
						30	03	28	FULL MOON

TABLE-I
CONVERSION OF MEAN SOLAR INTO SIDEREAL TIME
CORRECTION TO BE *ADDED* TO A MEAN TIME INTERVAL

HOURS			MINUTES				SECONDS			
Mean Time	Correction		Mean Time	Correction	Mean Time	Correction	Mean Time	Correction	Mean Time	Correction
h	m	s	m	s	m	s	s	s	s	s
1	0	09.856	1	0.164	31	5.093	1	.003	31	.085
2	0	19.713	2	0.329	32	5.257	2	.005	32	.088
3	0	29.569	3	0.493	33	5.421	3	.008	33	.090
4	0	39.426	4	0.657	34	5.585	4	.011	34	.093
5	0	49.282	5	0.821	35	5.750	5	.014	35	.096
6	0	59.139	6	0.986	36	5.914	6	.016	36	.099
7	1	08.995	7	1.150	37	6.078	7	.019	37	.101
8	1	18.852	8	1.314	38	6.242	8	.022	38	.104
9	1	28.708	9	1.478	39	6.407	9	.025	39	.107
10	1	38.565	10	1.643	40	6.571	10	.027	40	.110
11	1	48.421	11	1.807	41	6.735	11	.030	41	.112
12	1	58.278	12	1.971	42	6.900	12	.033	42	.115
13	2	08.134	13	2.136	43	7.064	13	.036	43	.118
14	2	17.991	14	2.300	44	7.228	14	.038	44	.120
15	2	27.847	15	2.464	45	7.392	15	.041	45	.123
16	2	37.704	16	2.628	46	7.557	16	.044	46	.126
17	2	47.560	17	2.793	47	7.721	17	.047	47	.129
18	2	57.417	18	2.957	48	7.885	18	.049	48	.131
19	3	07.273	19	3.121	49	8.049	19	.052	49	.134
20	3	17.129	20	3.285	50	8.214	20	.055	50	.137
21	3	26.986	21	3.450	51	8.378	21	.057	51	.140
22	3	36.842	22	3.614	52	8.542	22	.060	52	.142
23	3	46.699	23	3.778	53	8.707	23	.063	53	.145
24	3	56.555	24	3.943	54	8.871	24	.066	54	.148
			25	4.107	55	9.035	25	.068	55	.151
			26	4.271	56	9.199	26	.071	56	.153
			27	4.435	57	9.364	27	.074	57	.156
			28	4.600	58	9.528	28	.077	58	.159
			29	4.764	59	9.692	29	.079	59	.162
			30	4.928	60	9.856	30	.082	60	.164

Local Apparent Sidereal time for any given local mean time
= mean Sid. Time for 0^h U.T. (Pages 13 to 16)
— reduction for longitude of place
+ local mean time reckoned from midnight
+ correction for local mean time added (Table-I)
+ Equation of Equinoxes.

Local apparent Sidereal Time for any hour of Universal Time.
= Sid. Time for 0^h U.T. (Pages 13 to 16)
+ longitude of place (in time)
+ Universal Time
+ correction for U.T. added (Table-I)
+ Equation of Equinoxes.

N.B. The longitude of place is to be taken in time and regarded *positive* for places East of Greenwich. The reduction of Sidereal Time for the longitude of place may be taken from the above table and with the same sign as that of longitude. The correction for the L.M.T. or U.T. added should also be taken from the above table. For details, see the examples given under the EXPLANATION.

TABLE-II
CONVERSION OF SIDEREAL INTO MEAN SOLAR TIME
CORRECTION TO BE *SUBTRACTED* FROM A SIDEREAL TIME INTERVAL

HOURS			MINUTES				SECONDS			
Sidereal Time	Correction		Sidereal Time	Correction	Sidereal Time	Correction	Sidereal Time	Correction	Sidereal Time	Correction
h	m	s	m	s	m	s	s	s	s	s
1	0	09.830	1	0.164	31	5.079	1	.003	31	.085
2	0	19.659	2	0.328	32	5.242	2	.005	32	.087
3	0	29.489	3	0.491	33	5.406	3	.008	33	.090
4	0	39.318	4	0.655	34	5.570	4	.011	34	.093
5	0	49.148	5	0.819	35	5.734	5	.014	35	.096
6	0	58.977	6	0.983	36	5.898	6	.016	36	.098
7	1	08.807	7	1.147	37	6.062	7	.019	37	.101
8	1	18.636	8	1.311	38	6.225	8	.022`	38	.104
9	1	28.466	9	1.474	39	6.389	9	.025	39	.106
10	1	38.296	10	1.638	40	6.553	10	.027	40	.109
11	1	48.125	11	1.802	41	6.717	11	.030	41	.112
12	1	57.955	12	1.966	42	6.881	12	.033	42	.115
13	2	07.784	13	2.130	43	7.045	13	.035	43	.117
14	2	17.614	14	2.294	44	7.208	14	.038	44	.120
15	2	27.443	15	2.457	45	7.372	15	.041	45	.123
16	2	37.273	16	2.621	46	7.536	16	.044	46	.126
17	2	47.103	17	2.785	47	7.700	17	.046	47	.128
18	2	56.932	18	2.949	48	7.864	18	.049	48	.131
19	3	06.762	19	3.113	49	8.027	19	.052	49	.134
20	3	16.591	20	3.277	50	8.191	20	.055	50	.137
21	3	26.421	21	3.440	51	8.355	21	.057	51	.139
22	3	36.250	22	3.604	52	8.519	22	.060	52	.142
23	3	46.080	23	3.768	53	8.683	23	.063	53	.145
24	3	55.909	24	3.932	54	8.847	24	.066	54	.147
			25	4.096	55	9.010	25	.068	55	.150
			26	4.259	56	9.174	26	.071	56	.153
			27	4.423	57	9.338	27	.074	57	.156
			28	4.587	58	9.502	28	.076	58	.158
			29	4.751	59	9.666	29	.079	59	.161
			30	4.915	60	9.830	30	.082	60	.164

Local Mean Time for any given local apparent Sidereal Time
= Time of preceding transit of First Point of Aries (pages 13 to 16)
+ reduction for longitude of place
+ given local apparent Sidereal Time — Equation of Equinoxes
— correction for Sidereal Time added (Table-II).

Otherwise, L.M.T. for any given Sidereal Time may be obtained as follows:-
Given Sidereal Time
— Sidereal Time for 0^h U.T. (pages 13 to 16)
+ reduction for longitude of place
= Sidereal interval since 0^h L.M.T.
This Sidereal interval corrected by the above table gives the required local mean time.

or, Universal Time for any given Sidereal Time may be obtained as follows:-
Given Sidereal Time —longitude of place —Sidereal Time for 0^h U.T. = Sidereal interval since 0^h U.T.
This interval converted into Mean Solar Time by the above table gives the Universal Time required.

N.B. The reduction for longitude of place is of the same sign as that of the longitude, i.e. *positive* for places East of Greenwich and *negative* for West. See Example under EXPLANATION.

TABLE-III
CONVERSION OF ARC TO TIME

DEGREES						MINUTES		SECONDS			
°	h m	°	h m	°	h m	′	m s	″	s	″	s
0	0 00	49	3 16	98	6 32	0	0 00	0	0.000	0.00	0.000
1	0 04	50	3 20	99	6 36	1	0 04	1	0.067	.01	.001
2	0 08	51	3 24	100	6 40	2	0 08	2	0.133	.02	.001
3	0 12	52	3 28	101	6 44	3	0 12	3	0.200	.03	.002
4	0 16	53	3 32	102	6 48	4	0 16	4	0.267	.04	.003
5	0 20	54	3 36	103	6 52	5	0 20	5	0.333	.05	.003
6	0 24	55	3 40	104	6 56	6	0 24	6	0.400	.06	.004
7	0 28	56	3 44	105	7 00	7	0 28	7	0.467	.07	.005
8	0 32	57	3 48	106	7 04	8	0 32	8	0.533	.08	.005
9	0 36	58	3 52	107	7 08	9	0 36	9	0.600	.09	.006
10	0 40	59	3 56	108	7 12	10	0 40	10	0.667	0.10	0.007
11	0 44	60	4 00	109	7 16	11	0 44	11	0.733	.11	.007
12	0 48	61	4 04	110	7 20	12	0 48	12	0.800	.12	.008
13	0 52	62	4 08	111	7 24	13	0 52	13	0.867	.13	.009
14	0 56	63	4 12	112	7 28	14	0 56	14	0.933	.14	.009
15	1 00	64	4 16	113	7 32	15	1 00	15	1.000	.15	.010
16	1 04	65	4 20	114	7 36	16	1 04	16	1.067	.16	.011
17	1 08	66	4 24	115	7 40	17	1 08	17	1.133	.17	.011
18	1 12	67	4 28	116	7 44	18	1 12	18	1.200	.18	.012
19	1 16	68	4 32	117	7 48	19	1 16	19	1.267	.19	.013
20	1 20	69	4 36	118	7 52	20	1 20	20	1.333	0.20	0.013
21	1 24	70	4 40	119	7 56	21	1 24	21	1.400	.21	.014
22	1 28	71	4 44	120	8 00	22	1 28	22	1.467	.22	.015
23	1 32	72	4 48	121	8 04	23	1 32	23	1.533	.23	.015
24	1 36	73	4 52	122	8 08	24	1 36	24	1.600	.24	.016
25	1 40	74	4 56	123	8 12	25	1 40	25	1.667	.25	.017
26	1 44	75	5 00	124	8 16	26	1 44	26	1.733	.26	.017
27	1 48	76	5 04	125	8 20	27	1 48	27	1.800	.27	.018
28	1 52	77	5 08	126	8 24	28	1 52	28	1.867	.28	.019
29	1 56	78	5 12	127	8 28	29	1 56	29	1.933	.29	.019
30	2 00	79	5 16	128	8 32	30	2 00	30	2.000	0.30	0.020
31	2 04	80	5 20	129	8 36	31	2 04	31	2.067	.31	.021
32	2 08	81	5 24	130	8 40	32	2 08	32	2.133	.32	.021
33	2 12	82	5 28	131	8 44	33	2 12	33	2.200	.33	.022
34	2 16	83	5 32	132	8 48	34	2 16	34	2.267	.34	.023
35	2 20	84	5 36	133	8 52	35	2 20	35	2.333	.35	.023
36	2 24	85	5 40	134	8 56	36	2 24	36	2.400	.36	.024
37	2 28	86	5 44	135	9 00	37	2 28	37	2.467	.37	.025
38	2 32	87	5 48	136	9 04	38	2 32	38	2.533	.38	.025
39	2 36	88	5 52	137	9 08	39	2 36	39	2.600	.39	.026
40	2 40	89	5 56	138	9 12	40	2 40	40	2.667	0.40	0.027
41	2 44	90	6 00	139	9 16	41	2 44	41	2.733	.41	.027
42	2 48	91	6 04	140	9 20	42	2 48	42	2.800	.42	.028
43	2 52	92	6 08	141	9 24	43	2 52	43	2.867	.43	.029
44	2 56	93	6 12	142	9 28	44	2 56	44	2.933	.44	.029
45	3 00	94	6 16	143	9 32	45	3 00	45	3.000	.45	.030
46	3 04	95	6 20	144	9 36	46	3 04	46	3.067	.46	.031
47	3 08	96	6 24	145	9 40	47	3 08	47	3.133	.47	.031
48	3 12	97	6 28	146	9 44	48	3 12	48	3.200	.48	.032

″	s
0.50	0.033
.51	.034
.52	.035
.53	.035
.54	.036
.55	.037
.56	.037
.57	.038
.58	.039
.59	.039
0.60	0.040
.61	.041
.62	.041
.63	.042
.64	.043
.65	.043
.66	.044
.67	.045
.68	.045
.69	.046
0.70	0.047
.71	.047
.72	.048
.73	.049
.74	.049
.75	.050
.76	.051
.77	.051
.78	.052
.79	.053
0.80	0.053
.81	.054
.82	.055
.83	.055
.84	.056
.85	.057
.86	.057
.87	.058
.88	.059
.89	.059
0.90	0.06
.91	.061
.92	.061
.93	.062
.94	.063
.95	.063
.96	.064
97	.065
.98	.065

TABLE-III ---- *contd.*
CONVERSION OF ARC TO TIME

DEGREES						MINUTES		SECONDS					
°	h m	°	h m	°	h m	′	m s	″	s	″	s	″	s
147	9 48	158	10 32	169	11 16	49	3 16	49	3.267	0.49	0.033	0.99	0.066
148	9 52	159	10 36	170	11 20	50	3 20	50	3.333	0.50	0.033	1.00	0.067
149	9 56	160	10 40	171	11 24	51	3 24	51	3.400				
150	10 00	161	10 44	172	11 28	52	3 28	52	3.467				
151	10 04	162	10 48	173	11 32	53	3 32	53	3.533				
152	10 08	163	10 52	174	11 36	54	3 36	54	3.600				
153	10 12	164	10 56	175	11 40	55	3 40	55	3.667				
154	10 16	165	11 00	176	11 44	56	3 44	56	3.733				
155	10 20	166	11 04	177	11 48	57	3 48	57	3.800				
156	10 24	167	11 08	178	11 52	58	3 52	58	3.867				
157	10 28	168	11 12	179	11 56	59	3 56	59	3.933				

TABLE-IV
CONVERSION OF TIME TO ARC

	0^h	1^h	2^h	3^h	4^h	5^h	SECONDS					
m	° ′	° ′	° ′	° ′	° ′	° ′	s	′ ″	s	″	s	″
0	0 00	15 00	30 00	45 00	60 00	75 00	0	0 00	0.00	0.00	0.50	7.50
1	0 15	15 15	30 15	45 15	60 15	75 15	1	0 15	.01	0.15	.51	7.65
2	0 30	15 30	30 30	45 30	60 30	75 30	2	0 30	.02	0 30	.52	7.80
3	0 45	15 45	30 45	45 45	60 45	75 45	3	0 45	.03	0.45	.53	7.95
4	1 00	16 00	31 00	46 00	61 00	76 00	4	1 00	.04	0.60	.54	8.10
5	1 15	16 15	31 15	46 15	61 15	76 15	5	1 15	.05	0.75	.55	8.25
6	1 30	16 30	31 30	46 30	61 30	76 30	6	1 30	.06	0.90	.56	8.40
7	1 45	16 45	31 45	46 45	61 45	76 45	7	1 45	.07	1.05	.57	8.55
8	2 00	17 00	32 00	47 00	62 00	77 00	8	2 00	.08	1.20	.58	8.70
9	2 15	17 15	32 15	47 15	62 15	77 15	9	2 15	.09	1.35	.59	8.85
10	2 30	17 30	32 30	47 30	62 30	77 30	10	2 30	0.10	1.50	0.60	9.00
11	2 45	17 45	32 45	47 45	62 45	77 45	11	2 45	.11	1.65	.61	9.15
12	3 00	18 00	33 00	48 00	63 00	78 00	12	3 00	.12	1.80	.62	9.30
13	3 15	18 15	33 15	48 15	63 15	78 15	13	3 15	.13	1.95	.63	9.45
14	3 30	18 30	33 30	48 30	63 30	78 30	14	3 30	.14	2.10	.64	9.60
15	3 45	18 45	33 45	48 45	63 45	78 45	15	3 45	.15	2.25	.65	9.75
16	4 00	19 00	34 00	49 00	64 00	79 00	16	4 00	.16	2.40	.66	9.90
17	4 15	19 15	34 15	49 15	64 15	79 15	17	4 15	.17	2.55	.67	10.05
18	4 30	19 30	34 30	49 30	64 30	79 30	18	4 30	.18	2.70	.68	10.20
19	4 45	19 45	34 45	49 45	64 45	79 45	19	4 45	.19	2.85	.69	10.35
20	5 00	20 00	35 00	50 00	65 00	80 00	20	5 00	.20	3.00	0.70	10.50
21	5 15	20 15	35 15	50 15	65 15	80 15	21	5 15	.21	3.15	.71	10.65
22	5 30	20 30	35 30	50 30	65 30	80 30	22	5 30	.22	3.30	.72	10.80
23	5 45	20 45	35 45	50 45	65 45	80 45	23	5 45	.23	3.45	.73	10.95
24	6 00	21 00	36 00	51 00	66 00	81 00	24	6 00	.24	3.60	.74	11.10
25	6 15	21 15	36 15	51 15	66 15	81 15	25	6 15	.25	3.75	.75	11.25
26	6 30	21 30	36 30	51 30	66 30	81 30	26	6 30	.26	3.90	.76	11.40
27	6 45	21 45	36 45	51 45	66 45	81 45	27	6 45	.27	4.05	.77	11.55
28	7 00	22 00	37 00	52 00	67 00	82 00	28	7 00	.28	4.20	.78	11.70
29	7 15	22 15	37 15	52 15	67 15	82 15	29	7 15	.29	4.35	.79	11.85
30	7 30	22 30	37 30	52 30	67 30	82 30	30	7 30	.30	4.50	0.80	12.00

TABLE-IV ---- *contd.*
CONVERSION OF TIME TO ARC

	0^h	1^h	2^h	3^h	4^h	5^h	SECONDS					
m	° ′	° ′	° ′	° ′	° ′	° ′	s	′ ″	s	″	s	″
31	7 45	22 45	37 45	52 45	67 45	82 45	31	7 45	0.31	4.65	0.81	12.15
32	8 00	23 00	38 00	53 00	68 00	83 00	32	8 00	.32	4.80	.82	12.30
33	8 15	23 15	38 15	53 15	68 15	83 15	33	8 15	.33	4.95	.83	12.45
34	8 30	23 30	38 30	53 30	68 30	83 30	34	8 30	.34	5.10	.84	12.60
35	8 45	23 45	38 45	53 45	68 45	83 45	35	8 45	.35	5.25	.85	12.75
36	9 00	24 00	39 00	54 00	69 00	84 00	36	9 00	.36	5.40	.86	12.90
37	9 15	24 15	39 15	54 15	69 15	84 15	37	9 15	.37	5.55	.87	13.05
38	9 30	24 30	39 30	54 30	69 30	84 30	38	9 30	.38	5.70	.88	13.20
39	9 45	24 45	39 45	54 45	69 45	84 45	39	9 45	.39	5.85	.89	13.35
40	10 00	25 00	40 00	55 00	70 00	85 00	40	10 00	.40	6.00	.90	13.50
41	10 15	25 15	40 15	55 15	70 15	85 15	41	10 15	.41	6.15	.91	13.65
42	10 30	25 30	40 30	55 30	70 30	85 30	42	10 30	.42	6.30	.92	13.80
43	10 45	25 45	40 45	55 45	70 45	85 45	43	10 45	.43	6.45	.93	13.95
44	11 00	26 00	41 00	56 00	71 00	86 00	44	11 00	.44	6.60	.94	14.10
45	11 15	26 15	41 15	56 15	71 15	86 15	45	11 15	.45	6.75	.95	14.25
46	11 30	26 30	41 30	56 30	71 30	86 30	46	11 30	.46	6.90	.96	14.40
47	11 45	26 45	41 45	56 45	71 45	86 45	47	11 45	.47	7.05	.97	14.55
48	12 00	27 00	42 00	57 00	72 00	87 00	48	12 00	.48	7.20	.98	14.70
49	12 15	27 15	42 15	57 15	72 15	87 15	49	12 15	.49	7.35	0.99	14.85
50	12 30	27 30	42 30	57 30	72 30	87 30	50	12 30	0.50	7.50	1.00	15.00
51	12 45	27 45	42 45	57 45	72 45	87 45	51	12 45				
52	13 00	28 00	43 00	58 00	73 00	88 00	52	13 00				
53	13 15	28 15	43 15	58 15	73 15	88 15	53	13 15				
54	13 30	28 30	43 30	58 30	73 30	88 30	54	13 30		h	°	
55	13 45	28 45	43 45	58 45	73 45	88 45	55	13 45		6 =	90	
56	14 00	29 00	44 00	59 00	74 00	89 00	56	14 00		12 =	180	
57	14 15	29 15	44 15	59 15	74 15	89 15	57	14 15		18 =	270	
58	14 30	29 30	44 30	59 30	74 30	89 30	58	14 30				
59	14 45	29 45	44 45	59 45	74 45	89 45	59	14 45				

TABLE - V
CONVERSION OF HOURS, MINUTES AND SECONDS TO DECIMALS OF A DAY

	0^h	1^h	2^h	3^h	4^h	5^h	SECONDS	
m	d	d	d	d	d	d	s	d
0	0.000 000	0.041 667	0.083 333	0.125 000	0.166 667	0.208 333	0	0.000 000
1	.000 694	.042 361	.084 028	.125 694	.167 361	.209 028	1	.000 012
2	.001 389	.043 056	.084 722	.126 389	.168 056	.209 722	2	.000 023
3	.002 083	.043 750	.085 417	.127 083	.168 750	.210 417	3	.000 035
4	.002 778	.044 444	.086 111	.127 778	.169 444	.211 111	4	.000 046
5	.003 472	.045 139	.086 806	.128 472	.170 139	.211 806	5	.000 058
6	.004 167	.045 833	.087 500	.129 167	.170 833	.212 500	6	.000 069
7	.004 861	.046 528	.088 194	.129 861	.171 528	.213 194	7	.000 081
8	.005 556	.047 222	.088 889	.130 556	.172 222	.213 889	8	.000 093
9	.006 250	.047 917	.089 583	.131 250	.172 917	.214 583	9	.000 104
10	0.006 944	0.048 611	0.090 278	0.131 944	0.173 611	0.215 278	10	0.000 116
11	.007 639	.049 306	.090 972	0.132 639	.174 306	.215 972	11	.000 127

TABLE - V ---- *contd.*
CONVERSION OF HOURS, MINUTES AND SECONDS TO DECIMALS OF A DAY

	0 h	1 h	2 h	3 h	4 h	5 h	SECONDS	
m	d	d	d	d	d	d	s	d
12	0.008 333	0.050 000	0.091 667	0.133 333	0.175 000	0.216 667	12	0.000 139
13	.009 028	.050 694	.092 361	.134 028	.175 694	.217 361	13	.000 150
14	.009 722	.051 389	.093 056	.134 722	.176 389	.218 056	14	.000 162
15	.010 417	.052 083	.093 750	.135 417	.177 083	.218 750	15	.000 174
16	.011 111	.052 778	.094 444	.136 111	.177 778	.219 444	16	.000 185
17	.011 806	.053 472	.095 139	.136 806	. 178 472	.220 139	17	.000 197
18	.012 500	.054 167	.095 833	.137 500	.179 167	.220 833	18	.000 208
19	.013 194	.054 861	.096 528	.138 194	.179 861	.221 528	19	.000 220
20	0.013 889	0.055 556	0.097 222	0.138 889	0.180 556	0.222 222	20	0.000 231
21	.014 583	056 250	.097 917	.139 583	.181 250	.222 917	21	.000 243
22	.015 278	.056 944	.098 611	.140 278	.181 944	.223 611	22	.000 255
23	.015 972	.057 639	.099 306	.140 972	182 639	.224 306	23	.000 266
24	.016 667	.058 333	.100 000	.141 667	.183 333	.225 000	24	.000 278
25	.017 361	.059 028	.100 694	.142 361	.184 028	.225 694	25	.000 289
26	.018 056	.059 722	.101 389	.143 056	.184 722	.226 389	26	.000 301
27	.018 750	.060 417	.102 083	.143 750	.185 417	.227 083	27	.000 312
28	.019 444	.061 111	.102 778	.144 444	.186 111	.227 778	28	.000 324
29	.020 139	.061 806	.103 472	.145 139	.186 806	.228 472	29	.000 336
30	0.020 833	0.062 500	0.104 167	0.145 833	0.187 500	0.229 167	30	0.000 347
31	.021 528	.063 194	.104 861	.146 528	.188 194	.229 861	31	.000 359
32	.022 222	.063 889	.105 556	.147 222	.188 889	.230 556	32	.000370
33	.022 917	.064 583	.106 250	.147 917	.189 583	.231 250	33	.000 382
34	.023 611	.065 278	.106 944	.148 611	.190 278	.231 944	34	.000 394
35	.024 306	.065 972	.107 639	.149 306	.190 972	.232 639	35	.000 405
36	.025 000	.066 667	.108 333	.150 000	.191 667	.233 333	36	.000 417
37	.025 694	.067 361	.109 028	.150 694	.192 361	.234 028	37	.000 428
38	.026 389	.068 056	.109 722	.151 389	.193 056	.234 722	38	.000 440
39	.027 083	.068 750	.110 417	.152 083	.193 750	.235 417	39	.000 451
40	0.027 778	0.069 444	0.111 111	0.152 778	0.194 444	0.236 111	40	0.000 463
41	.028 472	.070 139	.111 806	.153 472	.195 139	.236 806	41	.000 475
42	.029 167	.070 833	.112 500	.154 167	.195 833	.237 500	42	.000 486
43	.029 861	.071 528	.113 194	.154 861	.196 528	.238 194	43	.000 498
44	.030 556	.072 222	.113 889	.155 556	.197 222	.238 889	44	.000 509
45	.031 250	.072 917	.114 583	.156 250	.197 917	.239 583	45	.000 521
46	.031 944	.073 611	.115 278	.156 944	.198 611	.240 278	46	.000 532
47	.032 639	.074 306	.115 972	.157 639	.199 306	.240 972	47	.000 544
48	.033 333	.075 000	.116 667	.158 333	.200 000	.241 667	48	.000 556
49	.034 028	.075 694	.117 361	.159 028	.200 694	.242 361	49	.000 567
50	0.034 722	0.076 389	0.118 056	0.159 722	0.201 389	0.243 056	50	0.000 579
51	.035 417	.077 083	.118 750	.160 417	.202 083	.243 750	51	.000 590
52	.036 111	.077 778	.119 444	.161 111	.202 778	.244 444	52	.000 602
53	.036 806	.078 472	.120 139	.161 806	.203 472	.245 139	53	.000 613
54	.037 500	.079 167	.120 833	.162 500	.204 167	.245 833	54	.000 625
55	.038 194	.079 861	.121 528	.163 194	.204 861	.246 528	55	.000 637
56	.038 889	.080 556	.122 222	.163 889	.205 556	.247 222	56	.000 648
57	.039 583	.081 250	.122 917	.164 583	.206 250	.247 917	57	.000 660
58	.040 278	.081 944	.123 611	.165 278	.206 944	.248 611	58	.000 671
59	0.040 972	0.082 639	0.124 306	0.165 972	0.207 639	0.249 306	59	0.000 683

TABLE - V ---- *contd.*

CONVERSION OF HOURS, MINUTES AND SECONDS TO DECIMALS OF A DAY

	6^h	7^h	8^h	9^h	10^h	11^h	SECONDS	
m	d	d	d	d	d	d	s	d
0	0.250 000	0.291 667	0.333 333	0.375 000	0.416 667	0.458 333	0	0.000 000
1	.250 694	.292 361	.334 028	.375 694	. 417 361	.459 028	1	.000 012
2	.251 389	.293 056	.334 722	.376 389	.418 056	.459 722	2	.000 023
3	.252 083	.293 750	.335 417	.377 083	.418 750	.460 417	3	.000 035
4	.252 778	.294 444	.336 111	.377 778	.419 444	.461 111	4	.000 046
5	.253 472	.295 139	.336 806	.378 472	.420 139	.461 806	5	.000 058
6	.254 167	.295 833	.337 500	.379 167	.420 833	.462 500	6	.000 069
7	.254 861	.296 528	338 194	.379 861	.421 528	. 463 194	7	.000 081
8	.255 556	.297 222	.338 889	.380 556	.422 222	. 463 889	8	.000 093
9	.256 250	.297 917	.339 583	.381 250	.422 917	.464 583	9	.000 104
10	0.256 944	0.298 611	0.340 278	0.381 944	0.423 611	0.465 278	10	0.000 116
11	.257 639	.299 306	.340 972	.382 639	.424 306	.465 972	11	.000 127
12	.258 333	.300 000	.341 667	.383 333	.425 000	.466 667	12	.000 139
13	.259 028	.300 694	.342 361	384 028	.425 694	.467 361	13	.000 150
14	.259 722	.301 389	.343 056	.384 722	.426 389	.468 056	14	.000 162
15	.260 417	.302 083	.343 750	.385 417	.427 083	.468 750	15	.000 174
16	.261 111	.302 778	.344 444	.386 111	.427 778	.469 444	16	.000 185
17	.261 806	.303 472	.345 139	.386 806	.428 472	.470 139	17	.000 197
18	.262 500	.304 167	.345 833	.387 500	.429 167	.470 833	18	.000 208
19	.263 194	.304 861	.346 528	.388 194	.429 861	.471 528	19	.000 220
20	0.263 889	0.305 556	0.347 222	0.388 889	0.430 556	0.472 222	20	0.000 231
21	.264 583	.306 250	.347 917	.389 583	.431 250	.472 917	21	.000 243
22	.265 278	.306 944	.348 611	.390 278	.431 944	.473 661	22	.000 255
23	.265 972	.307 639	.349 306	.390 972	.432 639	.474 306	23	.000 266
24	.266 667	.308 383	.350 000	.391 667	.433 333	.475 000	24	.000 278
25	.267 361	.309 028	.350 694	.392 361	.434 028	.475 694	25	.000289
26	.268 056	.309 722	.351 389	.393 056	.434 722	.476 389	26	.000 301
27	.268 750	.310 417	.352 083	.393 750	.435 417	.477 083	27	.000 312
28	.269 444	.311 111	.352 778	.394 444	.436 111	.477 778	28	.000 324
29	.270 139	.311 806	.353 472	.395 139	.436 806	.478 472	29	.000 336
30	0.270 833	0.312 500	0.354 167	0.395 833	0.437 500	0.479 167	30	0.000 347
31	.271 528	.313 194	.354 861	.396 528	.438 194	.479 861	31	.000 359
32	.272 222	.313 889	.355 556	.397 222	.438 889	.480 556	32	.000 370
33	.272 917	.314 583	.356 250	.397 917	.439 583	.481 250	33	.000 382
34	.273 611	.315 278	.356 944	.398 611	.440 278	.481 944	34	.000 394
35	.274 306	.315 972	.357 639	.399 306	.440 972	.482 639	35	.000 405
36	.275 000	.316 667	.358 333	.400 000	.441 667	.483 333	36	.000 417
37	.275 694	.317 361	.359 028	.400 694	.442 361	.484 028	37	.000 428
38	276 389	.318 056	.359 722	.401 389	.443 056	.484 722	38	.000 440
39	.277 083	.318 750	.360 417	.402 083	.443 750	.485 417	39	.000 451
40	0.277 778	0.319 444	0.361 111	0.402 778	0.444 444	0.486 111	40	0.000 463
41	.278 472	.320 139	.361 806	.403 472	.445 139	.486 806	41	.000 475
42	279 167	.320 833	.362 500	.404 167	.445 833	.487 500	42	.000 486
43	.279 861	.321 528	.363 194	.404 861	.446 528	.488 194	43	.000 498
44	.280 556	.322 222	.363 889	.405 556	.447 222	.488 889	44	.000 509
45	.281 250	.322 917	.364 583	.406 250	.447 917	.489 583	45	.000 521
46	0.281 944	0.323 611	0.365 278	0.406 944	0.448 611	0.490 278	46	0.000 532

TABLE - V ---- *contd.*
CONVERSION OF HOURS, MINUTES AND SECONDS TO DECIMALS OF A DAY

	6^h	7^h	8^h	9^h	10^h	11^h	SECONDS	
m	d	d	d	d	d	d	s	d
47	0.282 639	0.324 306	0.365 972	0.407 639	0.449 306	0.490 972	47	0.000 544
48	.283 333	.325 000	.366 667	.408 333	.450 000	.491 667	48	.000 556
49	.284 028	.325 694	.367 361	.409 028	.450 694	.492 361	49	.000 567
50	0.284 722	0.326 389	0.368 056	0.409 722	0.451 389	0.493 056	50	0.000 579
51	.285 417	.327 083	.368 750	.410 417	.452 083	.493 750	51	.000 590
52	.286 111	.327 778	.369 444	.411 111	.452 778	.494 444	52	.000 602
53	.286 806	.328 472	. 370 139	.411 806	.453 472	.495 139	53	.000 613
54	.287 500	.329 167	.370 833	.412 500	.454 167	.495 833	54	.000 625
55	.288 194	.329 861	.371 528	.413 194	.454 861	.496 528	55	.000 637
56	.288 889	.330 556	.372 222	.413 889	.455 556	.497 222	56	.000 648
57	.289 583	.331 250	.372 917	.414 583	.456 250	.497 917	57	.000 660
58	.290 278	.331 944	.373 611	.415 278	.456 944	.498 611	58	.000 671
59	0.290 972	0.332 639	0.374 306	0.415 972	0.457 639	0.499 306	59	0.000 683

TABLE - VI
CONVERSION OF MINUTES AND SECONDS TO DECIMALS OF A DEGREE

	0′	1′	2′	3′	4′	5′		
″	°	°	°	°	°	°	″	°
0	0.00000	0.01667	0.03333	0.05000	0.06667	0.08333	0	0.0
1	0028	1694	3361	5028		8361	6	0.1
2	0056	1722	3389	5056	6722	8389	12	0.2
3	0083	1750	3417	5083	6750	8417	18	0.3
4	0111	1778	3444	5111	6778	8444	24	0.4
5	0139	1806	3472	5139	6806	8472	30	0.5
6	0167	1833	3500	5167	6833	8500	36	0.6
7	0194	1861	3528	5194	6861	8528	42	0.7
8	0222	1889	3556	5222	6889	8556	48	0.8
9	0250	1917	3583	5250	6917	8583	54	0.9
10	0.00278	0.01944	0.03611	0.05278	0.06944	0.08611		
11	0306	1972	3639	5306	6972	8639		
12	0333	2000	3667	5333	7000	8667		
13	0361	2028	3694	5361	7028	8694		
14	0389	2056	3722	5389	7056	8722		
15	0417	2083	3750	5417	7083	8750		
16	0444	2111	3778	5444	7111	8778		
17	0472	2139	3806	5472	7139	8806		
18	0500	2167	3833	5500	7167	8833		
19	0528	2194	3861	5528	7194	8861		
20	0.00556	0.02222	0.03889	0.05556	0.07222	0.08889		
21	0583	2250	3917	5583	7250	8917		
22	0611	2278	3944	5611	7278	8944		
23	0639	2306	3972	5639	7306	8972		
24	0667	2333	4000	5667	7333	9000		
25	0.00694	0.02361	0.04028	0.05694	0.07361	0.09028		

TABLE - VI ---- *contd.*
CONVERSION OF MINUTES AND SECONDS TO DECIMALS OF A DEGREE

	0′	1′	2′	3′	4′	5′
″	°	°	°	°	°	°
26	0.00722	0.02389	0.04056	0.05722	0.07389	0.09056
27	0750	2417	4083	5750	7417	9083
28	0778	2444	4111	5778	7444	9111
29	0806	2472	4139	5806	7472	9139
30	0.00833	0.02500	0.04167	0.05833	0.07500	0.09167
31	0861	2528	4194	5861	7528	9194
32	0889	2556	4222	5889	7556	9222
33	0917	2583	4250	5917	7583	9250
34	0944	2611	4278	5944	7611	9278
35	0972	2639	4306	5972	7639	9306
36	1000	2667	4333	6000	7667	9333
37	1028	2694	4361	6028	7694	9361
38	1056	2722	4389	6056	7722	9389
39	1083	2750	4417	6083	7750	9417
40	0.01111	0.02778	0.04444	0.06111	0.07778	0.09444
41	1139	2806	4472	6139	7806	9472
42	1167	2833	4500	6167	7833	9500
43	1194	2861	4528	6194	7861	9528
44	1222	2889	4556	6222	7889	9556
45	1250	2917	4583	6250	7917	9583
46	1278	2944	4611	6278	7944	9611
47	1306	2972	4639	6306	7972	9639
48	1333	3000	4667	6333	8000	9667
49	1361	3028	4694	6361	8028	9694
50	0.01389	0.03056	0.04722	0.06389	0.08056	0.09722
51	1417	3083	4750	6417	8083	9750
52	1444	3111	4778	6444	8111	9778
53	1472	3139	4806	6472	8139	9806
54	1500	3167	4833	6500	8167	9833
55	1528	3194	4861	6528	8194	9861
56	1556	3222	4889	6556	8222	9889
57	1583	3250	4917	6583	8250	9917
58	1611	3278	4944	6611	8278	9944
59	0.01639	0.03306	0.04972	0.06639	0.08306	0.09972

In units of the fifth decimal of a Degree.

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0.98	
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1.00	

In critical cases ascend

TABLE - VII
INTERPOLATION COEFFICIENTS

n	*B*″	E_0″	E_1″	n	*B*″	E_0″	E_1″
0.00	0.00000	0.00000	0.00000	0.05	0.01188	0.01544	0.00831
.01	.00248	.00328	.00167	.06	0.01410	0.01824	0.00996
.02	.00490	.00647	.00333	.07	.01628	.02094	.01161
.03	.00728	.00955	.00500	.08	.01840	.02355	.01325
.04	.00960	.01254	.00666	.09	.02048	.02607	.01488
0.05	0.01188	0.01544	0.00831	0.10	0.02250	0.02850	0.01650

TABLE - VII ---- *contd.*
INTERPOLATION COEFFICIENTS

n	*B″*	*E₀″*	*E₁″*	n	*B″*	*E₀″*	*E₁″*
0.10	0.02250	0.02850	0.01650	0.55	0.06188	0.05981	0.06394
.11	.02448	.03084	.01811	.56	0.06160	0.05914	0.06406
.12	.02640	.03309	.01971	.57	.06128	.05842	.06413
.13	.02828	.03525	.02130	.58	.06090	.05765	.06415
.14	.03010	.03732	.02288	.59	.06048	.05685	.06410
.15	.03188	.03931	.02444	0.60	0.06000	0.05600	0.06400
.16	.03360	.04122	.02598	.61	.05948	.05511	.06384
.17	.03528	.04304	.02751	.62	.05890	.05419	.06361
.18	.03690	.04477	.02903	.63	.05828	.05322	.06333
.19	.03848	.04643	.03052	.64	.05760	.05222	.06298
0.20	0.04000	0.04800	0.03200	.65	.05688	.05119	.06256
.21	.04148	.04949	.03346	.66	.05610	.05012	.06208
.22	.04290	.05091	.03489	.67	.05528	.04901	.06154
.23	.04428	.05224	.03631	.68	.05440	.04787	.06093
.24	.04560	.05350	.03770	.69	.05348	.04670	.06025
.25	.04688	.05469	.03906	0.70	0.05250	0.04550	0.05950
.26	.04810	.05580	.04040	.71	.05148	.04427	.05868
.27	.04928	.05683	.04172	.72	.05040	.04301	.05779
.28	.05040	.05779	.04301	.73	.04928	.04172	.05683
.29	.05148	.05868	.04427	.74	.04810	.04040	.05580
0.30	0.05250	0.05950	0.04550	.75	.04688	.03906	.05469
.31	.05348	.06025	.04670	.76	.04560	.03770	.05350
.32	.05440	.06093	.04787	.77	.04428	.03631	.05224
.33	.05528	.06154	.04901	.78	.04290	.03489	.05091
.34	.05610	.06208	.05012	.79	.04148	.03346	.04949
.35	.05688	.06256	.05119	0.80	0.04000	0.03200	0.04800
.36	.05760	.06298	.05222	.81	. 03848	.03052	.04643
.37	.05828	.06333	.05322	.82	.03690	.02903	.04477
.38	.05890	.06361	.05419	.83	.03528	.02751	.04304
.39	.05948	.06384	.05511	.84	.03360	.02598	.04122
0.40	0.06000	0.06400	0.05600	.85	.03188	.02444	.03931
.41	.06048	.06410	.05685	.86	.03010	.02288	.03732
.42	.06090	.06415	.05765	.87	.02828	.02130	.03525
.43	.06128	.06413	.05842	.88	.02640	.01971	.03309
.44	.06160	.06406	.05914	.89	.02448	.01811	.03084
.45	.06188	.06394	.05981	0.90	0.02250	0.01650	0.02850
.46	.06210	.06376	.06044	.91	.02048	.01488	.02607
.47	.06228	.06352	.06103	.92	.01840	.01325	.02355
.48	.06240	.06323	.06157	.93	.01628	.01161	.02094
.49	.06248	.06289	.06206	.94	.01410	.00996	.01824
0.50	0.06250	0.06250	0.06250	.95	.01188	.00831	.01544
.51	.06248	.06206	.06289	.96	.00960	.00666	.01254
.52	.06240	.06157	.06323	.97	.00728	.00500	.00955
.53	.06228	.06103	.06352	.98	.00490	.00333	.00647
.54	.06210	.06044	.06376	0.99	.00248	.00167	.00328
0.55	0.06188	0.05981	0.06394	1.00	0.00000	0.00000	0.00000

N.B. – The coefficients are all *negative*. For details about Bessel's and Everett's interpolation formula, please *see* Explanation

TABLE - VIII
EVERETT COEFFICIENTS OF THE SECOND DIFFERENCES
(*The coefficients are all negative*)

n	E_0''	E_1''		n	E_0''	E_1''		n	E_0''	E_1''	
0.000	0.0002	0.0001	1.000	0.050	0.0156	0.0084	0.950	0.100	0.0286	0.0166	0.900
.001	.0005	.0002	0.999	.051	.0159	.0086	.949	.101	.0289	.0167	.899
.002	.0008	.0004	.998	.052	.0161	.0087	.948	.102	.0291	.0169	.898
.003	.0012	.0006	.997	.053	.0164	.0089	.947	.103	.0293	.0171	.897
.004	.0015	.0007	.996	.054	.0167	.0091	.946	.104	.0296	.0172	.896
.005	.0018	.0009	.995	.055	.0170	.0092	.945	.105	.0298	.0174	.895
.006	.0021	.0011	.994	.056	.0173	.0094	.944	.106	.0300	.0175	.894
.007	.0025	.0012	.993	.057	.0175	.0096	.943	.107	.0303	.0177	.893
.008	.0028	.0014	.992	.058	.0178	.0097	.942	.108	.0305	.0179	.892
.009	.0031	.0016	.991	.059	.0181	.0099	.941	.109	.0307	.0180	.891
.010	.0034	.0017	.990	.060	.0184	.0100	.940	.110	.0310	.0182	.890
.011	.0038	.0019	.989	.061	.0186	.0102	.939	.111	.0312	.0184	.889
.012	.0041	.0021	.988	.062	.0189	.0104	.938	.112	.0314	.0185	.888
.013	.0044	.0022	.987	.063	.0192	.0105	.937	.113	.0316	.0187	.887
.014	.0047	.0024	.986	.064	.0195	.0107	.936	.114	.0319	.0188	.886
.015	.0050	.0026	.985	.065	.0197	.0109	.935	.115	.0321	.0190	.885
.016	.0054	.0027	.984	.066	.0200	.0110	.934	.116	.0323	.0192	.884
.017	.0057	.0029	.983	.067	.0203	.0112	.933	.117	.0325	.0193	.883
.018	.0060	.0031	.982	.068	.0205	.0114	.932	.118	.0328	.0195	.882
.019	.0063	.0032	.981	.069	.0208	.0115	.931	.119	.0330	.0196	.881
.020	.0066	.0034	.980	.070	.0211	.0117	.930	.120	.0332	.0198	.880
.021	.0069	.0036	.979	.071	.0213	.0119	.929	.121	.0334	.0200	.879
.022	.0072	.0037	.978	.072	.0216	.0120	.928	.122	.0336	.0201	.878
.023	.0076	.0039	.977	.073	.0219	.0122	.927	.123	.0339	.0203	.877
.024	.0079	.0041	.976	.074	.0221	.0123	.926	.124	.0341	.0204	.876
.025	.0082	.0042	.975	.075	.0224	.0125	.925	.125	.0343	.0206	.875
.026	.0085	.0044	.974	.076	.0226	.0127	.924	.126	.0345	.0207	.874
.027	.0088	.0046	.973	.077	.0229	.0128	.923	.127	.0347	.0209	.873
.028	.0091	.0047	.972	.078	.0232	.0130	.922	.128	.0349	.0211	.872
.029	.0094	.0049	.971	.079	.0234	.0132	.921	.129	.0351	.0212	.871
.030	.0097	.0051	.970	.080	.0237	.0133	.920	.130	.0354	.0214	.870
.031	.0100	.0052	.969	.081	.0239	.0135	.919	.131	.0356	.0215	.869
.032	.0103	.0054	.968	.082	.0242	.0137	.918	.132	.0358	.0217	.868
.033	.0106	.0056	.967	.083	.0244	.0138	.917	.133	.0360	.0219	.867
.034	.0109	.0057	.966	.084	.0247	.0140	.916	.134	.0362	.0220	.866
.035	.0112	.0059	.965	.085	.0249	.0141	.915	.135	.0364	.0222	.865
.036	.0115	.0061	.964	.086	.0252	.0143	.914	.136	.0366	.0223	.864
.037	.0118	.0062	.963	.087	.0255	.0145	.913	.137	.0368	.0225	.863
.038	.0121	.0064	.962	.088	.0257	.0146	.912	.138	.0370	.0226	.862
.039	.0124	.0066	.961	.089	.0259	.0148	.911	.139	.0372	.0228	.861
.040	.0127	.0067	.960	.090	.0262	.0150	.910	.140	.0374	.0230	.860
.041	.0130	.0069	.959	.091	.0264	.0151	.909	.141	.0376	.0231	.859
.042	.0133	.0071	.958	.092	.0267	.0153	.908	.142	.0378	.0233	.858
.043	.0136	.0072	.957	.093	.0269	.0154	.907	.143	.0380	.0234	.857
.044	.0139	.0074	.956	.094	.0272	.0156	.906	.144	.0382	.0236	.856
.045	.0141	.0076	.955	.095	.0274	.0158	.905	.145	.0384	.0237	.855
.046	.0144	.0077	.954	.096	.0277	.0159	. 904	.146	.0386	.0239	.854
.047	.0147	.0079	.953	.097	.0279	.0161	.903	.147	.0388	.0240	.853
.048	.0150	.0081	.952	.098	.0281	.0163	.902	.148	.0390	.0242	.852
.049	0.0153	0.0082	.951	.099	0.0284	0.0164	.901	.149	0.0392	0.0244	.851
0.050			0.950	0.100			0.900	0.150			0.850
	E_1''	E_0''	n		E_1''	E_0''	n		E_1''	E_0''	n

Formula : $f_n = f_0 + n\,\Delta_{1/2}' + E_0''\Delta_0'' + E_1''\Delta_1''$

TABLE - VIII ---- *contd.*
EVERETT COEFFICIENTS OF THE SECOND DIFFERENCES
(*The coefficients are all negative*)

n	E_0''	E_1''		n	E_0''	E_1''		n	E_0''	E_1''	
0.150	0.0394	0.0245	0.850	0.200	0.0482	0.0321	0.800	0.300	0.0597	0.0457	0.700
.151	.0396	.0247	.849	.202	.0485	.0324	.798	.304	.0600	.0462	.696
.152	.0398	.0248	.848	.204	.0488	.0327	.796	.308	.0602	.0467	.692
.153	.0400	.0250	.847	.206	.0491	.0330	.794	.312	.0605	.0472	.688
.154	.0402	.0251	.846	.208	.0493	.0333	.792	.316	.0608	.0476	.684
.155	.0404	.0253	.845	.210	.0496	.0336	.790	.320	.0611	.0481	.680
.156	.0406	.0254	.844	.212	.0499	.0339	.788	.324	.0613	.0486	.676
.157	.0407	.0256	.843	.214	.0502	.0342	.786	.328	.0615	.0490	.672
.158	.0409	.0258	.842	.216	.0505	.0345	.784	.332	.0618	.0495	.668
.159	.0411	.0259	.841	.218	.0508	.0347	.782	.336	.0620	.0499	.664
.160	.0413	.0261	.840	.220	.0510	.0350	.780	.340	.0622	.0503	.660
.161	.0415	.0262	.839	.222	.0513	.0353	.778	.344	.0624	.0508	.656
.162	.0417	.0264	.838	.224	.0516	.0356	.776	.348	.0626	.0512	.652
.163	.0419	.0265	.837	.226	.0519	.0359	.774	.352	.0627	.0516	.648
.164	.0420	.0267	.836	.228	.0521	.0362	.772	.356	.0629	.0520	.644
.165	.0422	.0268	.835	.230	.0524	.0364	.770	.360	.0631	.0524	.640
.166	.0424	.0270	.834	.232	.0526	.0367	.768	.364	.0632	.0528	.636
.167	.0426	.0271	.833	.234	.0529	.0370	.766	.368	.0633	.0532	.632
.168	.0428	.0273	.832	.236	.0531	.0373	.764	.372	.0634	.0536	.628
.169	.0429	.0274	.831	.238	.0534	.0376	.762	.376	.0636	.0540	.624
.170	.0431	.0276	.830	.240	.0536	.0378	.760	.380	.0637	.0544	.620
.171	.0433	.0277	.829	.242	.0539	.0381	.758	.384	.0638	.0547	.616
.172	.0435	.0279	.828	.244	.0541	.0384	.756	.388	.0638	.0551	.612
.173	.0437	.0280	.827	.246	.0543	.0387	.754	.392	.0639	.0555	.608
.174	.0438	.0282	.826	.248	.0546	.0389	.752	.396	.0640	.0558	.604
.175	.0440	.0283	.825	.250	.0548	.0392	.750	.400	.0640	.0562	.600
.176	.0442	.0285	.824	.252	.0550	.0395	.748	.404	.0641	.0565	.596
.177	.0443	.0287	.823	.254	.0553	.0397	.746	.408	.0641	.0568	.592
.178	.0445	.0288	.822	.256	.0555	.0400	.744	.412	.0641	.0572	.588
.179	.0447	.0290	.821	.258	.0557	.0403	.742	.416	.0641	.0575	.584
.180	.0449	.0291	.820	.260	.0559	.0405	.740	.420	.0641	.0578	.580
.181	.0450	.0293	.819	.262	.0561	.0408	.738	.424	.0641	.0581	.576
.182	.0452	.0294	.818	.264	.0563	.0411	.736	.428	.0641	.0584	.572
.183	.0454	.0296	.817	.266	.0565	.0413	.734	.432	.0641	.0587	.568
.184	.0455	.0297	.816	.268	.0567	.0416	.732	.436	.0641	.0590	.564
.185	.0457	.0299	.815	.270	.0569	.0418	.730	.440	.0640	.0593	.560
.186	.0459	.0300	.814	.272	.0571	.0421	.728	.444	.0640	.0595	.556
.187	.0460	.0302	.813	.274	.0573	.0424	.726	.448	.0639	.0598	.552
.188	.0462	.0303	.812	.276	.0575	.0426	.724	.452	.0639	.0601	.548
.189	.0463	.0304	.811	.278	.0577	.0429	.722	.456	.0638	.0603	.544
.190	.0465	.0306	.810	.280	.0579	.0431	.720	.460	.0637	.0606	.540
.191	.0467	.0307	.809	.282	.0581	.0434	.718	.464	.0636	.0608	.536
.192	.0468	.0309	.808	.284	.0582	.0436	.716	.468	.0635	.0610	.532
.193	.0470	.0310	.807	.286	.0584	.0439	.714	.472	.0634	.0613	.528
.194	.0471	.0312	.806	.288	.0586	.0441	.712	.476	.0633	.0615	.524
.195	.0473	.0313	.805	.290	.0588	.0444	.710	.480	.0632	.0617	.520
.196	.0475	.0315	.804	.292	.0589	.0446	.708	.484	.0630	.0619	.516
.197	.0476	.0316	.803	.294	.0591	.0449	.706	.488	.0629	.0621	.512
.198	.0478	.0318	.802	.296	.0593	.0451	.704	.492	.0627	.0622	.508
.199	0.0479	0.0319	.801	.298	0.0594	0.0454	.702	.496	0.0626	0.0624	.504
0.200			0.800	0.300			0.700	0.500			0.500
	E_1''	E_0''	n		E_1''	E_0''	n		E_1''	E_0''	n

N. B. -- The table is to be used like a critical table without interpolation

TABLE - IX
JULIAN DAY NUMBER

DAYS ELAPSED AT GREENWICH NOON OF JANUARY 0

Yr. A.D.	100	200	300	400	500	600	700	800	900	1000
0	175 7582	179 4107	183 0632	186 7157	190 3682	194 0207	197 6732	201 3257	204 9782	208 6307
20	176 4887	180 1412	183 7937	187 4462	191 0987	194 7512	198 4037	202 0562	205 7087	209 3612
40	177 2192	180 8717	184 5242	188 1767	191 8292	195 4817	199 1342	202 7867	206 4392	210 0917
60	177 9497	181 6022	185 2547	188 9072	192 5597	196 2122	199 8647	203 5172	207 1697	210 8222
80	178 6802	182 3327	185 9852	189 6377	193 2902	196 9427	200 5952	204 2477	207 9002	211 5527

Yr. A.D.	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
							*	*	*	
0	212 2832	215 9357	219 5882	223 2407	226 8932	230 5447	234 1971	237 8495	241 5020	245 1544
20	213 0137	216 6662	220 3187	223 9712	227 6237	231 2752	234 9276	238 5806	242 2324	245 8849
40	213 7442	217 3967	221 0492	224 7017	228 3542	232 0057	235 6581	239 3105	242 9629	246 6154
60	214 4747	218 1272	221 7797	225 4322	229 0847	232 7362	236 3886	240 0410	243 6934	247 3459
80	215 2052	218 8577	222 5102	226 1627	229 8152	233 4667	237 1191	240 7715	244 4239	248 0764
					†					
100	215 9357	219 5882	223 2407	226 8932	230 5447	234 1971	237 8495	241 5020	245 1544	248 8069

NUMBER OF DAYS TO BE ADDED TO REDUCE TO THE BEGINNING OF EACH MONTH

Year	Jan. 0	Feb. 0	Mar. 0	Apr. 0	May 0	Jun. 0	July 0	Aug. 0	Sept. 0	Oct. 0	Nov. 0	Dec. 0
	*	*										
0	0	31	60	91	121	152	182	213	244	274	305	335
1	366	397	425	456	486	517	547	578	609	639	670	700
2	731	762	790	821	851	882	912	943	974	1004	1035	1065
3	1096	1127	1155	1186	1216	1247	1277	1308	1339	1369	1400	1430
4	1461	1492	1521	1552	1582	1613	1643	1674	1705	1735	1766	1796
5	1827	1858	1886	1917	1947	1978	2008	2039	2070	2100	2131	2161
6	2192	2223	2251	2282	2312	2343	2373	2404	2435	2465	2496	2526
7	2557	2588	2616	2647	2677	2708	2738	2769	2800	2830	2861	2891
8	2922	2953	2982	3013	3043	3074	3104	3135	3166	3196	3227	3257
9	3288	3319	3347	3378	3408	3439	3469	3500	3531	3561	3592	3622
10	3353	3684	3712	3743	3773	3804	3834	3865	3896	3926	3957	3987
11	4018	4049	4077	4108	4138	4169	4199	4230	4261	4291	4322	4352
12	4383	4414	4443	4474	4504	4535	4565	4596	4627	4657	4688	4718
13	4749	4780	4808	4839	4869	4900	4930	4961	4992	5022	5053	5083
14	5114	5145	5173	5204	5234	5265	5295	5326	5357	5387	5418	5448
15	5479	5510	5538	5569	5599	5630	5660	5691	5722	5752	5783	5813
16	5844	5875	5904	5935	5965	5996	6026	6057	6088	6118	6149	6179
17	6210	6241	6269	6300	6330	6361	6391	6422	6453	6483	6514	6544
18	6575	6606	6634	6665	6695	6726	6756	6787	6818	6848	6879	6909
19	6940	6971	6999	7030	7060	7091	7121	7152	7183	7213	7244	7274

† From 1582 October 15 to 1599 December 31 inclusive, Gregorian calendar, the numbers given by the above tables must be diminished by 10.

* The numbers given for the years 1700, 1800 and 1900 which are not leap years, are for January - 1 and consequently the numbers 0 and 31 for January 0 and February 0 of these years must be increased by 1 and read as 1 and 32 respectively.

N.B. To find the Julian Day Number for a B.C. date, first express the year astronomically, i.e. diminish it by 1 and put a negative sign before it. Then make the number positive by adding the smallest multiple of 1000. The Julian Day Number for the date thus obtained diminished by 365250 for each multiple of 1000 added will give the required Julian Day Number for the B.C. date in question.

The Julian Day is completed at noon. In order to obtain the Julian Day Number for 0^h U.T., diminish the figure obtained from the above tables by 0.5.

The tables give the Day Numbers upto 1582, Oct. 4 for the Julian calendar and from 1582, Oct. 15 onward for the Gregorian calendar.

TABLE – X

ATMOSPHERIC REFRACTION

MEAN REFRACTION FOR TEMPERATURE 25° C AND PRESSURE 1000 mb

Apparent Altitude	Mean Refraction	Apparent Altitude	Mean Refraction	Apparent Altitude	Mean Refraction	Apparent Altitude	Mean Refraction
° ′	′ ″	° ′	′ ″	° ′	′ ″	°	′ ″
-1 00	46 17.5	6 10	7 39.0	17 30	2 49.6	53	0 40.8
0 00	30 59.6	20	7 28.5	18 00	2 44.7	54	39.3
+0 10	29 09.3	30	7 18.5	18 30	2 40.0	55	37.9
20	27 28.9	40	7 08.9	19 00	2 35.6	56	36.5
30	25 57.8	6 50	6 59.7	19 30	2 31.4	57	35.1
0 40	24 34.6	7 00	6 50.8	20 00	2 27.3	58	33.8
0 50	23 18.3	7 10	6 42.3	21 00	2 19.8	59	0 32.6
1 00	22 07.9	20	6 34.1	22 00	2 12.9	60	31.2
10	21 02.6	30	6 26.3	23 00	2 06.6	61	30.0
20	20 02.4	40	6 18.7	24 00	2 00.8	62	28.8
30	19 07.0	7 50	6 11.4	25 00	1 55.4	63	27.6
1 40	18 15.6	8 00	6 04.4	26 00	1 50.4	64	26.4
1 50	17 28.2	8 10	5 57.6	27 00	1 45.7	65	0 25.2
2 00	16 44.0	20	5 51.2	28 00	1 41.3	66	24.1
10	16 02.6	30	5 44.7	29 00	1 37.2	67	23.0
20	15 24.0	40	5 38.6	30 00	1 33.4	68	21.9
30	14 48.0	8 50	5 32.6	31 00	1 29.8	69	20.8
2 40	14 14.4	9 00	5 26.8	32 00	1 26.3	70	19.7
2 50	13 42.9	9 10	5 21.3	33 00	1 23.1	71	0 18.6
3 00	13 13.5	20	5 15.9	34 00	1 20.0	72	17.6
10	12 45.8	30	5 10.6	35 00	1 17.1	73	16.5
20	12 19.6	40	5 05.5	36 00	1 14.3	74	15.5
30	11 55.0	9 50	5 00.6	37 00	1 11.7	75	14.5
3 40	11 31.9	10 00	4 55.9	38 00	1 09.1	76	13.5
3 50	11 10.0	10 30	4 42.4	39 00	1 06.8	77	0 12.5
4 00	10 49.5	11 00	4 30.0	40 00	1 04.4	78	11.5
10	10 30.1	11 30	4 18.7	41 00	1 02.2	79	10.5
20	10 11.7	12 00	4 08.1	42 00	1 00.0	80	09.5
30	9 54.2	12 30	3 58.4	43 00	0 57.9	81	08.6
4 40	9 37.5	13 00	3 49.3	44 00	0 56.0	82	07.6
4 50	9 21.6	13 30	3 40.8	45 00	0 54.1	83	0 06.6
5 00	9 06.5	14 00	3 32.9	46 00	0 52.2	84	05.7
10	8 52.1	14 30	3 25.6	47 00	0 50.4	85	04.7
20	8 38.6	15 00	3 18.6	48 00	0 48.7	86	03.8
30	8 25.5	15 30	3 12.1	49 00	0 47.0	87	02.8
5 40	8 13.0	16 00	3 06.0	50 00	0 45.4	88	01.9
5 50	8 01.2	16 30	3 00.2	51 00	0 43.8	89	0 00.9
6 00	7 49.8	17 00	2 54.8	52 00	0 42.2	90	0 00.0
6 10	7 39.0	17 30	2 49.6	53 00	0 40.8		

Rule: True altitude of a celestial object = Its apparent or observed altitude - refraction.

N.B.-The figures of mean refraction given in the above table are for temperature 25° C and pressure 1000 mb. (750.06 mm. Or 29.530 inches of mercury barometer). For other values of temperature and pressure, corrections form the tables on the following two pages are to be taken and applied to the mean refraction.

TABLE - Xa
ATMOSPHERIC REFRACTION
CORRECTION OF MEAN REFRACTION FOR DIFFERENT VALUES OF TEMPERATURE

Apparent Altitude	- 10° C (14° F)	0° C (32° F)	10° C (50° F)	20° C (68° F)	25° C (77° F)	30° C (86° F)	40° C (104° F)	50° C (122° F)
° ′	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
- 1 00	+ 13 31.7	+ 9 17.8	+ 5 13.4	+ 1 37.7	0 00.0	- 1 32.6	- 4 22.5	- 6 54.8
0 00	7 16.3	5 04.8	2 53.4	0 54.8	0 00.0	0 52.1	2 29.6	3 58.2
+ 0 30	5 39.4	3 57.4	2 15.6	0 42.8	0 00.0	0 41.2	1 58.4	3 09.1
1 00	4 27.7	3 07.8	1 47.8	0 34.7	0 00.0	0 32.1	1 33.8	2 30.7
1 30	3 38.4	2 33.1	1 27.9	0 27.8	0 00.0	0 27.1	1 18.1	2 05.2
2 00	3 00.9	2 07.0	1 13.1	0 23.4	0 00.0	0 22.4	1 05.0	1 44.5
2 30	+ 2 32.9	+ 1 48.1	+ 1 02.1	+ 0 19.6	0 00.0	- 0 19.5	- 0 56.0	- 1 29.9
3 00	2 12.7	1 33.2	0 53.8	0 17.2	0 00.0	0 16.7	0 48.2	1 17.5
3 30	1 56.6	1 21.9	0 47.3	0 15.1	0 00.0	0 14.6	0 42.4	1 08.3
4 00	1 43.2	1 12.5	0 42.0	0 13.5	0 00.0	0 12.9	0 37.6	1 00.6
4 30	1 32.5	1 05.0	0 37.9	0 12.0	0 00.0	0 11.7	0 33.9	0 54.5
5 00	1 23.7	0 58.9	0 35.0	0 10.9	0 00.0	0 10.6	0 30.7	0 49.5
6 00	+ 1 10.2	+ 0 49.4	+ 0 30.0	+ 0 09.1	0 00.0	- 0 09.0	- 0 25.8	- 0 41.5
7 00	1 00.3	0 42.5	0 25.6	0 07.9	0 00.0	0 07.6	0 22.1	0 35.7
8 00	0 52.7	0 37.1	0 21.4	0 06.9	0 00.0	0 06.6	0 19.4	0 31.3
9 00	0 46.8	0 32.9	0 19.1	0 06.1	0 00.0	0 05.9	0 17.2	0 27.8
10 00	0 43.0	0 29.6	0 17.1	0 05.4	0 00.0	0 05.3	0 15.5	0 25.0
11 00	0 39.4	0 26.9	0 15.6	0 05.0	0 00.0	0 04.8	0 14.1	0 22.8
12 00	+ 0 35.7	+ 0 24.3	+ 0 14.2	+ 0 04.6	0 00.0	- 0 04.4	- 0 12.8	- 0 20.7
13 00	0 33.1	0 22.6	0 13.2	0 04.2	0 00.0	0 04.0	0 11.9	0 19.2
14 00	0 30.4	0 21.0	0 12.1	0 03.9	0 00.0	0 03.7	0 11.0	0 17.7
15 00	0 28.4	0 19.6	0 11.3	0 03.6	0 00.0	0 03.5	0 10.2	0 16.5
16 00	0 26.4	0 18.2	0 10.3	0 03.4	0 00.0	0 03.3	0 09.5	0 15.4
17 00	0 24.8	0 17.2	0 09.9	0 03.2	0 00.0	0 03.1	0 08.9	0 14.4
18 00	+ 0 23.3	+ 0 16.2	+ 0 09.3	+ 0 03.0	0 00.0	- 0 02.9	- 0 08.4	- 0 13.5
19 00	0 22.1	0 15.2	0 08.8	0 02.7	0 00.0	0 02.7	0 07.9	0 12.8
20 00	0 20.9	0 14.3	0 08.3	0 02.5	0 00.0	0 02.6	0 07.5	0 12.1
25 00	0 16.3	0 11.2	0 06.5	0 02.1	0 00.0	0 02.0	0 05.9	0 09.4
30 00	0 13.1	0 09.0	0 05.2	0 01.7	0 00.0	0 01.6	0 04.7	0 07.6
35 00	0 10.8	0 07.4	0 04.3	0 01.4	0 00.0	0 01.3	0 03.9	0 06.3
40 00	+ 0 09.0	+ 0 06.2	+ 0 03.6	+ 0 01.2	0 00.0	- 0 01.1	- 0 03.2	- 0 05.2
45 00	0 07.5	0 05.2	0 03.0	0 01.0	0 00.0	0 00.9	0 02.7	0 04.4
50 00	0 06.0	0 04.4	0 02.5	0 00.8	0 00.0	0 00.8	0 02.3	0 03.7
55 00	0 05.3	0 03.6	0 02.1	0 00.7	0 00.0	0 00.7	0 02.0	0 03.1
60 00	0 04.4	0 03.0	0 01.8	0 00.6	0 00.0	0 00.6	0 01.6	0 02.5
65 00	0 03.6	0 02.4	0 01.4	0 00.5	0 00.0	0 00.5	0 01.3	0 02.1
70 00	+ 0 02.8	+ 0 01.9	+ 0 01.1	+ 0 00.4	0 00.0	- 0 00.4	- 0 01.0	- 0 01.6
75 00	0 02.0	0 01.4	0 00.8	0 00.3	0 00.0	0 00.3	0 00.7	0 01.2
80 00	0 01.4	0 00.9	0 00.5	0 00.2	0 00.0	0 00.2	0 00.4	0 00.8
85 00	0 00.7	0 00.4	0 00.2	0 00.1	0 00.0	0 00.1	0 00.2	0 00.4
90 00	+ 0 00.0	+ 0 00.0	+ 0 00.0	+ 0 00.0	0 00.0	- 0 00.0	- 0 00.0	- 0 00.0

TABLE - Xb

ATMOSPHERIC REFRACTION

PRESSURE CORRECTION OF REFRACTION FOR DIFFERENT VALUES OF PRESSURE

PRESSURE			AMOUNT OF REFRACTION CORRECTED FOR PRESSURE							
			1′	2′	3′	5′	10′	20′	30′	60′
mb	mm	Inch	″	″	″	′ ″	′ ″	′ ″	′ ″	′ ″
660	495.0	19.49	- 20.4	- 40.8	- 61.3	- 1 42.3	- 3 26.5	- 7 04.9	- 10 59.1	- 24 19
670	502.5	19.79	19.8	39.7	59.5	1 39.3	3 20.4	6 52.5	10 39.8	23 36
680	510.0	20.08	19.2	38.4	57.7	1 36.3	3 14.3	6 39.8	10 20.2	22 53
690	517.5	20.38	18.6	37.2	55.9	1 33.3	3 08.2	6 27.4	10 00.9	22 10
700	525.0	20.67	18.0	36.0	54.1	1 30.3	3 02.2	6 14.9	9 41.5	21 27
710	532.5	20.97	17.4	34.8	52.3	1 27.3	2 56.1	6 02.5	9 22.2	20 45
720	540.0	21.26	- 16.8	- 33.5	- 50.6	- 1 24.3	- 2 50.0	- 5 50.0	- 9 02.8	- 20 01
730	547.5	21.56	16.2	32.4	48.7	1 21.2	2 43.9	5 37.4	8 43.3	19 18
740	555.0	21.85	15.6	31.2	46.9	1 18.2	2 37.8	5 24.9	8 23.9	18 35
750	562.6	22.15	15.0	30.0	45.1	1 15.2	2 31.8	5 12.4	8 04.6	17 53
760	570.1	22.44	14.4	28.9	43.3	1 12.3	2 25.8	5 00.2	7 45.6	17 21
770	577.6	22.74	13.8	27.6	41.5	1 09.2	2 19.7	4 47.5	7 25.9	16 27
780	585.1	23.03	- 13.2	- 26.4	- 39.7	- 1 06.2	- 2 13.6	- 4 35.0	- 7 06.5	- 15 44
790	592.6	23.33	12.6	25.2	37.9	1 03.2	2 07.6	4 22.5	6 47.2	15 01
800	600.1	23.62	12.0	24.0	36.0	1 00.2	2 01.4	4 09.9	6 27.6	14 18
810	607.6	23.92	11.4	22.8	34.3	0 57.2	1 55.4	3 57.5	6 08.3	13 35
820	615.1	24.22	10.8	21.6	32.4	0 54.2	1 49.3	3 44.9	5 48.9	12 52
830	622.6	24.51	10.2	20.4	30.7	0 51.2	1 43.3	3 32.5	5 29.6	12 10
840	630.1	24.81	- 9.6	- 19.2	- 28.9	- 0 48.2	- 1 37.2	- 3 20.0	- 5 10.2	- 11 27
850	637.6	25.10	9.0	18.0	27.0	0 45.1	1 31.1	3 07.4	4 50.7	10 43
860	645.1	25.40	8.4	16.8	25.2	0 42.1	1 25.0	2 54.9	4 31.3	10 01
870	652.6	25.69	7.8	15.6	23.4	0 39.1	1 19.0	2 42.5	4 12.0	9 18
880	660.1	25.99	7.2	14.4	21.6	0 36.1	1 12.9	2 30.0	3 52.6	8 35
890	667.6	26.28	6.6	13.2	19.8	0 33.1	1 06.8	2 17.5	3 33.3	7 52
900	675.1	26.58	- 6.0	- 12.0	- 18.0	- 0 30.1	- 1 00.7	- 2 04.9	- 3 13.7	- 7 09
910	682.6	26.87	5.4	10.8	16.2	0 27.1	0 54.7	1 52.5	2 54.3	6 26
920	690.1	27.17	4.8	9.6	14.4	0 24.1	0 48.6	1 39.9	2 35.0	5 43
930	697.6	27.46	4.2	8.4	12.6	0 21.1	0 42.5	1 27.5	2 15.7	5 01
940	705.1	27.76	3.6	7.2	10.8	0 18.1	0 36.4	1 15.0	1 50.3	4 17
950	712.6	28.05	3.0	6.0	9.0	0 15.0	0 30.3	1 02.4	1 36.9	3 34
960	720.1	28.35	- 2.4	- 4.8	- 7.2	- 0 12.0	- 0 24.3	- 0 49.9	- 1 17.4	- 2 51
970	727.6	28.64	1.8	3.6	5.4	0 09.0	0 18.2	0 37.5	0 58.2	2 09
980	735.1	28.94	1.2	2.4	3.6	0 06.0	0 12.1	0 25.0	0 38.7	1 26
990	742.6	29.24	- 0.6	- 1.2	- 1.8	- 0 03.0	- 0 06.1	- 0 12.5	- 0 19.4	- 0 43
1000	750.1	29.53	0.0	0.0	0.0	0 00.0	0 00.0	0 00.0	0 00.0	0 00
1010	757.6	29.83	+ 0.6	+ 1.2	+ 1.8	+ 0 03.1	+ 0 06.1	+ 0 12.5	+ 0 19.5	+ 0 43
1020	765.1	30.12	1.2	2.4	3.6	0 06.0	0 12.2	0 25.1	0 38.9	1 26
1030	772.6	30.42	1.8	3.6	5.4	0 09.0	0 18.2	0 37.5	0 58.2	2 09
1040	780.1	30.71	2.4	4.8	7.2	0 12.0	0 24.3	0 50.0	0 77.6	2 52
1050	787.6	31.01	+ 3.0	+ 6.0	+ 9.0	+ 0 15.0	+ 0 30.3	+ 0 62.4	+ 0 96.9	+ 3 24

TABLE - XI
FACTORS FOR COMPUTING THE GEOCENTRIC COORDINATES OF A PLACE

ϕ	S	C	ϕ	S	C
°			°		
0	0.993306	1.000000	45	0.994972	1.001678
1	0.993307	1.000001	46	0.995031	1.001737
2	0.993310	1.000004	47	0.995089	1.001795
3	0.993315	1.000009	48	0.995147	1.001854
4	0.993322	1.000016	49	0.995205	1.001912
5	0.993331	1.000025	50	0.995262	1.001970
6	0.993342	1.000037	51	0.995320	1.002028
7	0.993355	1.000050	52	0.995377	1.002085
8	0.993370	1.000065	53	0.995433	1.002142
9	0.993387	1.000082	54	0.995489	1.002198
10	0.993406	1.000101	55	0.995544	1.002254
11	0.993427	1.000122	56	0.995599	1.002309
12	0.993449	1.000145	57	0.995652	1.002363
13	0.993474	1.000169	58	0.995705	1.002416
14	0.993500	1.000196	59	0.995758	1.002468
15	0.993528	1.000224	60	0.995809	1.002520
16	0.993558	1.000254	61	0.995859	1.002570
17	0.993590	1.000286	62	0.995908	1.002620
18	0.993623	1.000320	63	0.995956	1.002668
19	0.993658	1.000355	64	0.996002	1.002715
20	0.993695	1.000392	65	0.996048	1.002761
21	0.993733	1.000430	66	0.996092	1.002805
22	0.993773	1.000470	67	0.996135	1.002848
23	0.993814	1.000511	68	0.996176	1.002890
24	0.993856	1.000554	69	0.996216	1.002930
25	0.993900	1.000598	70	0.996255	1.002969
26	0.993945	1.000644	71	0.996291	1.003006
27	0.993992	1.000691	72	0.996327	1.003041
28	0.994039	1.000739	73	0.996360	1.003075
29	0.994088	1.000788	74	0.996392	1.003107
30	0.994138	1.000838	75	0.996422	1.003138
31	0.994189	1.000889	76	0.996451	1.003166
32	0.994241	1.000941	77	0.996477	1.003193
33	0.994293	1.000994	78	0.996502	1.003218
34	0.994347	1.001048	79	0.996525	1.003241
35	0.994401	1.001103	80	0.996546	1.003262
36	0.994456	1.001158	81	0.996565	1.003281
37	0.994512	1.001214	82	0.996582	1.003299
38	0.994568	1.001271	83	0.996597	1.003314
39	0.994625	1.001328	84	0.996610	1.003327
40	0.994682	1.001386	85	0.996622	1.003338
41	0.994740	1.001444	86	0.996631	1.003348
42	0.994798	1.001502	87	0.996638	1.003355
43	0.994856	1.001560	88	0.996643	1.003360
44	0.994914	1.001619	89	0.996646	1.003363
45	0.994972	1.001678	90	0.996647	1.003364

$\rho \sin \phi' = (S+H) \sin \phi$ $\qquad$ $\rho \cos \phi' = (C+H) \cos \phi$

$H = 0.156779 \times$ elevation in meters $\times 10^{-6}$ $\qquad$ $H = 0.047786 \times$ elevation in feet $\times 10^{-6}$

TABLE - XII
CONVERSION OF GEOGRAPHIC TO GEOCENTRIC COORDINATES

φ	φ′ - φ	ρ	ONE DEGREE OF Latitude	ONE DEGREE OF Longitude	φ	φ′ - φ	ρ	ONE DEGREE OF Latitude	ONE DEGREE OF Longitude
°	′ ″		Kilometers	Kilometers	°	′ ″		Kilometers	Kilometers
0	0 00.0	1.000000	110.57	111.32	45	- 11 32.7	0.998331	111.13	78.85
1	- 0 24.1	0.999999	110.58	111.30	46	11 32.4	0.998272	111.15	77.46
2	0 48.2	0.999996	110.58	111.25	47	11 31.2	0.998214	111.17	76.06
3	1 12.2	0.999991	110.58	111.17	48	11 29.2	0.998155	111.19	74.63
4	1 36.1	0.999984	110.58	111.05	49	11 26.3	0.998097	111.21	73.17
5	1 59.9	0.999975	110.58	110.90	50	11 22.6	0.998039	111.23	71.70
6	2 23.6	0.999964	110.59	110.71	51	11 18.1	0.997982	111.25	70.20
7	2 47.0	0.999951	110.59	110.50	52	11 12.7	0.997925	111.27	68.68
8	3 10.3	0.999936	110.60	110.24	53	11 06.5	0.997868	111.29	67.14
9	3 33.4	0.999919	110.60	109.96	54	10 59.5	0.997812	111.31	65.58
10	- 3 56.2	0.999900	110.61	109.64	55	- 10 51.7	0.997756	111.32	63.99
11	4 18.7	0.999879	110.62	109.29	56	10 43.1	0.997702	111.34	62.39
12	4 40.9	0.999856	110.62	108.90	57	10 33.7	0.997648	111.36	60.77
13	5 02.8	0.999832	110.63	108.49	58	10 23.5	0.997594	111.38	59.13
14	5 24.3	0.999805	110.64	108.03	59	10 12.6	0.997542	111.40	57.48
15	5 45.4	0.999777	110.65	107.55	60	10 00.9	0.997491	111.41	55.80
16	6 06.0	0.999747	110.66	107.03	61	9 48.5	0.997440	111.43	54.11
17	6 26.3	0.999716	110.67	106.49	62	9 35.4	0.997391	111.45	52.40
18	6 46.1	0.999682	110.68	105.91	63	9 21.5	0.997343	111.46	50.67
19	7 05.4	0.999647	110.69	105.29	64	9 07.0	0.997296	111.48	48.93
20	- 7 24.1	0.999611	110.70	104.65	65	- 8 51.8	0.997250	111.49	47.18
21	7 42.4	0.999573	110.72	103.97	66	8 36.0	0.997206	111.51	45.40
22	8 00.0	0.999533	110.73	103.26	67	8 19.5	0.997163	111.52	43.62
23	8 17.1	0.999492	110.74	102.52	68	8 02.4	0.997121	111.54	41.82
24	8 33.6	0.999449	110.76	101.75	69	7 44.7	0.997081	111.55	40.01
25	8 49.5	0.999405	110.77	100.95	70	7 26.4	0.997042	111.56	38.19
26	9 04.7	0.999360	110.79	100.12	71	7 07.6	0.997005	111.57	36.35
27	9 19.3	0.999314	110.80	99.26	72	6 48.3	0.996970	111.59	34.50
28	9 33.2	0.999266	110.82	98.36	73	6 28.4	0.996936	111.60	32.65
29	9 46.4	0.999217	110.84	97.44	74	6 08.1	0.996904	111.61	30.78
30	- 9 58.9	0.999167	110.85	96.49	75	- 5 47.4	0.996874	111.61	28.90
31	10 10.7	0.999116	110.87	95.50	76	5 26.2	0.996845	111.62	27.02
32	10 21.7	0.999064	110.89	94.49	77	5 04.6	0.996818	111.63	25.12
33	10 32.0	0.999011	110.90	93.45	78	4 42.6	0.996793	111.64	23.22
34	10 41.5	0.998958	110.92	92.39	79	4 20.3	0.996770	111.65	21.31
35	10 50.2	0.998903	110.94	91.29	80	3 57.7	0.996749	111.66	19.39
36	10 58.1	0.998848	110.96	90 16	81	3 34.7	0.996730	111.67	17.47
37	11 05.3	0.998792	110.98	89.01	82	3 11.6	0.996713	111.67	15.54
38	11 11.6	0.998736	111.00	87.83	83	2 48.1	0.996697	111.68	13.61
39	11 17.1	0.998679	111.02	86.63	84	2 24.5	0.996684	111.68	11.67
40	-11 21.8	0.998622	111.03	85.39	85	- 2 00.7	0.996673	111.69	9.73
41	11 25.7	0.998564	111.05	84.14	86	1 36.7	0.996664	111.69	7.79
42	11 28.7	0.998506	111.07	82.85	87	1 12.7	0.996656	111.69	5.85
43	11 30.9	0.998447	111.09	81.54	88	0 48.5	0.996651	111.69	3.90
44	11 32.2	0.998389	111.11	80.21	89	- 0 24.3	0.996648	111.69	1.95
45	-11 32.7	0.998331	111.13	78.85	90	0 00.0	0.996647	111.69	0.00

φ and φ′ are the geographic and geocentric latitude respectively
ρ = radius of the earth.
1 kilometre = 0.621372 miles.

LATITUDE AND LONGITUDE OF PLACES

Place	Altitude (Metre)	Latitude	Longitude In arc	Longitude In time	Reduction of Greenwich Sid. Time	Reduction of L.M.T. to Indian Standard Time	ρ sin φ′	ρ cos φ′
		° ′	° ′	h m s	s	m s		
Agartala	16	+23 31.8	+ 91 09.0	+6 04 36	+59.89	-34 36	+0.39677	0.91734
Agra	160	+27 05.6	+ 77 34.8	+5 10 19	+50.98	+19 51	+0.45272	0.89091
Ahmedabad	49	+23 03.0	+ 72 40.2	+4 50 41	+47.75	+39 19	+0.38912	0.92064
Aizawl	1097	+23 26.4	+ 92 43.2	+6 10 53	+60.93	-40 53	+0.39540	0.91812
Ajmer	486	+26 16.2	+ 74 22.2	+4 57 29	+48.87	+32 31	+0.43996	0.89738
Alibag (Obs.) Mumbai,	7	+19 00.0	+ 72 30.6	+4 50 02	+47.65	+39 58	+0.33350	0.94586
Aligarh	187	+27 31.8	+ 78 2.44	+5 12 10	+51.28	+17 47	+0.45946	0.88743
Allahabad	96	+25 16.2	+ 81 26.4	+5 25 46	+53.51	+04 14	+0.42429	0.90487
Amritsar	231	+31 22.8	+ 74 31.2	+4 58 05	+48.97	+31 55	+0.51771	0.85454
Bangalore	921	+12 34.8	+ 77 21.0	+5 09 24	+50.83	+20 36	+0.21641	0.97629
Bangkok, Thailand	16	+13 25.0	+100 18.0	+6 41 12	+65.91	- 71 12	+0.23052	0.97289
Baroda	35	+22 12.0	+ 73 9.6	+4 52 38	+48.07	+37 22	+0.37549	0.92632
Bhopal	506	+23 10.2	+ 77 12.6	+5 08 50	+50.73	+21 10	+0.39106	0.91989
Bhuj	105	+23 09.0	+ 69 24.0	+4 37 36	+45.60	+52 24	+0.39072	0.91997
Bhubaneswar	46	+20 00.0	+ 85 30.0	+5 42 00	+56.18	- 12 00	+0.33987	0.94007
Bikaner	224	+28 01.0	+ 73 10.8	+4 52 43	+48.09	+37 17	+0.46695	0.88349
Bilaspur,(H.P)	502	+31 11.4	+ 76 30.0	+5 06 00	+50.27	+24 00	+0.51491	0.85629
Buenos Aires (Naval Obs.), Argentina	6	-34 21.0	- 58 12.0	- 3 52 48	-38.24	.. ..	-0.56107	0.82649
Cairo	68	+30 01.0	+ 31 09.0	+2 04 36	+20.47	.. ..	+0.49733	0.86662
Canberra (Mount Stromlo), Australia	767	-35 10.2	+149 10.5	+9 56 42	+98.02	.. ..	-0.57285	0.81845
Cape Town (Ast. Obs.), S. Africa	18	-33 33.6	+ 18 15.0	+1 13 00	+11.99	.. ..	-0.54967	0.83416
Chandigarh	347	+30 25.2	+ 76 32.0	+5 06 08	+50.29	+23 52	+0.50340	0.86312
Chennai (or Madras) Obs.	7	+13 00.0	+ 80 06.6	+5 20 26	+52.64	+ 9 34	+0.22348	0.97454
Chittagong, Bangladesh	27	+22 12.6	+ 91 31.8	+6 06 07	+60.14	- 36 07	+0.37565	0.92625
Colaba Obs. Mumbai, (Bombay)	14	+19 04.2	+ 72 31.0	+4 50 04	+47.65	+39 56	+0.32465	0.94546
Colombo (Obs.), Srilanka	6	+ 6 33.6	+ 79 33.6	+5 18 14	+52.28	+11 46	+011348	0.99350
Cuttack	26	+20 16.8	+ 85 33.6	+5 42 14	+56.42	- 12 14	+0.34443	0.93839
Dacca,Bangladesh	7	+23 25.8	+ 90 15.6	+6 01 02	+59.31	- 31 02	+0.39518	0.91803
Darjeeling	2128	+27 02.0	+ 88 10.8	+5 52 43	+57.94	- 22 43	+0.45193	0.89166
Dehra Dun	682	+30 11.3	+ 78 01.2	+5 12 05	+51.27	+17 55	+0.49995	0.86520
Delhi	220	+28 21.0	+ 77 07.2	+5 08 29	+50.68	+21 31	+0.47205	0.88076
Dibrugarh	106	+27 17.4	+ 94 06.0	+6 16 24	+61.83	- 46 24	+0.45575	0.88734
Gangtok	1768	+27 12.0	+ 88 22.2	+5 53 29	+58.07	- 23 29	+0.45448	0.89029
Guwahati	55	+26 3.6.0	+ 91 21.0	+6 05 24	+60.03	- 35 24	+0.43666	0.89892
Gauribidanur (Radio Astr. Obs.)	686	+13 36.2	+ 77 26.1	+5 09 44	+50.88	+20 16	+0.23369	0.97223
Gaya	111	+24 27.0	+ 84 34.2	+5 38 17	+55.57	- 8 17	+0.41137	0.91086

1 metre = 3.2808 feet

LATITUDE AND LONGITUDE OF PLACES

Place	Altitude (Metre)	Latitude	Longitude		Reduction of Greenwich Sid. Time	Reduction of L.M.T. to Indian Standard Time	ρ sin φ′	ρ cos φ′
			In arc	In time				
		° ′	° ′	h m s	s	m s		
Geneva (Obs.), Switzerland	465	+46 07.8	+ 6 04.2	+0 24 17	+ 3.99	.. ..	+0.71739	0.69428
Greenwich (Royal Obs.).	47	+51 28.6	0 00	0 00 00.0	0.00	.. ..	+0.77872	0.62412
Hanle/ Mt.Saraswati (Indian Ast. Obs.)	4467	+32 46.8	+ 78 57.9	+5 15 51.6	+51.89	+14 8.4	+0.53870	0.84217
Haridwar	274	+29 34.8	+ 78 08.0	+5 12 32.0	+51.34	+ 17 28	+0.49076	0.87041
Heidelberg Obs., Germany	570	+49 14.0	+ 8 25.2	+0 33 41.0	+ 5.53	.. ..	+0.75382	0.65430
Helwan (Obs.), Egypt	116	+29 51.5	+ 31 22.8	+2 05 31.2	+20.62	.. ..	+0.49494	0.86800
Herstmonceux (Royal Obs.), Sussex, U.K.	31	+50 52.0	+ 0 20.3	+0 01 21.0	+ 0.22	.. ..	+0.77205	0.63241
Hyderabad (Nizamiah Obs.)	554	+17 25.9	+ 78 27.2	+5 13 49.0	+51.55	+ 16 11	+0.29768	0.95444
Imphal	801	+24 26.4	+ 93 34.8	+6 14 19.0	+61.49	- 44 19	+0.41126	0.91103
India, Central Station of	-	+23 11.0	+ 82 30.0	+5 30 00.0	+54.21	0 00	+0.39124	0.91973
Indore	556	+22 26.4	+ 75 30.0	+5 02 00.0	+49.61	+ 28 00	+0.37938	0.92481
Istambul (Univ. Obs.), Turkey	65	+41 00.7	+ 28 57.9	+1 55 51.6	+19.03	.. ..	+0.65277	0.75567
IUCAA Giravali Obs., Pune	1000	+18 19.2	+ 73 30.6	+4 54 02.0	+48.3	+35 58	+0.31237	0.94978
Jabalpur	393	+23 07.2	+ 79 34.2	+5 18 17.0	+52.29	+ 11 43	+0.39026	0.92022
Jaipur	436	+26 33.0	+ 75 31.2	+5 02 05.0	+49.62	+ 27 55	+0.44431	0.89520
Jakarta, Indonesia	23	- 6 07.2	+106 30.0	+7 06 00.0	+69.98	.. ..	-0.10590	0.99434
Jamshedpur	152	+22 29.4	+ 86 06.6	+5 44 26.0	+56.58	- 14 26	+0.38016	0.92442
Japal Rangapur (Obs.),	695	+17 05.9	+ 78 43.7	+5 14 55.0	+51.73	+ 15 05	+0.29216	0.95618
Jodhpur	224	+26 10.8	+ 73 00.6	+4 52 02.0	+47.97	+ 37 58	+0.43854	0.89803
Johannesberg, South Africa	1806	- 26 10.9	+ 28 04.5	+1 52 18.0	+18.45	.. ..	-0.43868	0.89824
Kabul, Afghanistan	1766	+34 18.0	+ 69 10.8	+4 36 43.0	+45.46	+ 53 17	+0.56051	0.82721
Kanchipuram	76	+12 30.0	+ 79 27.0	+5 17 48.0	+52.21	+ 12 12	+0.21503	0.97646
Kanpur	126	+26 15.6	+ 80 13.2	+5 20 53.0	+52.71	+ 9 07	+0.43978	0.89740
Karachi, Pakistan	4	+24 53.6	+ 67 02.4	+4 28 10.0	+44.05	+ 61 50	+0.41836	0.90763
Kathmandu, Nepal	1324	+27 23.2	+ 85 07.2	+5 40 29.0	+55.93	- 10 29	+0.45733	0.88874
Kavalur (Vainu Bappu Obs.),	725	+12 34.6	+ 78 49.6	+5 15 18.0	+51.80	+ 14 42	+0.21635	0.97627
Kodaikanal (Solar Obs.)	2343	+10 13.8	+ 77 28.1	+5 09 52.0	+50.90	+ 20 08	+0.17649	0.98457
Kohima	1405	+25 24.0	+ 94 04.8	+6 16 19.0	+61.82	- 46 19	+0.42642	0.90409
Kolkata (Alipore Obs.), (Calcutta)	6	+22 19.2	+ 88 12.0	+5 52 48.0	+57.96	- 22 48	+0.37742	0.92553
Kolkata (Presi. Coll. Obs.)	12	+22 23.4	+ 88 16.2	+5 53 05.0	+58.00	- 23 05	+0.37854	0.92506
Kurnool	281	+15 30.0	+ 78 03.0	+5 12 12.0	+51.29	+ 17 48	+0.26552	0.96390

1 metre = 3.2808 feet

LATITUDE AND LONGITUDE OF PLACES

Place	Altitude (Metre)	Latitude	Longitude In arc	Longitude In time	Reduction of Greenwich Sid. Time	Reduction of L.M.T. to Indian Standard Time	ρ sin φ′	ρ cos φ′
		° ′	° ′	h m s	s	m s		
Kyoto (Univ. Ast. Dept. Obs.), Japan	86	+35 00.6	+135 20.4	+9 1 22.0	+88.93	.. ..	+0.57052	0.81997
Lahore, Pakistan	214	+31 22.2	+ 74 15.6	+4 57 02.0	+48.80	+ 32 58	+0.51756	0.85269
Lucknow	113	+26 31.2	+ 80 33.6	+5 22 14.0	+52.94	+ 7 46	+0.44383	0.89539
Maitri (Indian base station at Antarctica)	132	-70 46.0	+ 11 45.0	+0 47 00.0	+ 7.72	.. ..	-0.94069	0.33041
Mangalore	22	+12 33.0	+ 74 31.8	+4 58 07.0	+48.97	+ 31 53	+0.21587	0.97626
Moscow (Sternberg State Ast. Inst.), Russia	195	+55 27.0	+ 37 22.2	+2 29 29.0	+24.56	.. ..	+0.82001	0.56843
Mount Abu (Gurushikhar Obs.)	1700	+24 23.4	+ 72 25.8	+4 49 43.0	+47.59	+40 17	+0.41053	0.91152
Mount Palomar (Obs.), U.S.A.	1706	+33 21.4	-116 51.8	- 7 47 27.2	-76.79	.. ..	+054687	0.83633
Mount Wilson (Obs.), U.S.A.	1742	+34 13.0	-118 03.6	- 7 52 14.4	-77.58	.. ..	+0.55931	0.82802
Mysore	767	+12 10.8	+ 76 25.2	+5 05 41.0	+50.22	+ 24 19	+0.20963	0.97775
Nagpur	312	+21 05.4	+ 79 04.2	+5 16 17.0	+51.96	+ 13 43	+0.35760	0.93347
Nainital (Aryabhatta Res. Inst. Of Obs. Sci.)	1927	+29 13.8	+ 79 18.0	+5 17 12.0	+52.11	+ 12 48	+0. 48558	0.87363
New York (Rutherford Obs.), U.S.A.	25	+40 25.8	- 74 00.6	- 4 56 02.0	-48.63	.. ..	+0.64509	0.76228
Ottawa, Canada	87	+45 16.2	- 75 22.2	- 5 01 29.0	-49.53	.. ..	+0.70688	0.70497
Panaji	56	+15 18.0	+ 73 33.0	+4 54 12.0	+48.33	+ 35 48	+0.26217	0.96479
Paris (Obs.), France	67	+48 30.0	+ 2 12.0	+0 08 49.0	+ 1.45	.. ..	+0.74535	0.66387
Patiala	251	+30 12.0	+ 76 15.0	+5 05 00.0	+50.10	+ 25 00	+0.50010	0.86504
Patna	53	+25 21.6	+ 85 03.6	+5 40 14.0	+55.89	- 10 14	+0.42570	0.90420
Peshawar, Pakistan	358	+34 01.0	+ 71 34.0	+4 46 15.0	+47.03	+ 43 45	+0.55630	0.82979
Pondicherry	6	+11 34.8	+ 79 29.4	+5 17 58.0	+52.23	+ 12 02	+0. 19942	0.97978
Pune	559	+18 19.0	+ 73 30.0	+4 54 00.0	+48 .30	+ 36 00	+0.31230	0.94973
Porbandar	7	+21 22.2	+ 69 29.4	+4 37 58.0	+45.66	+ 52 02	+0.36211	0.93166
Port Blair	79	+11 24.0	+ 92 25.8	+6 09 43.0	+60.74	- 39 43	+0.19636	0.98041
Puri	6	+19 28.8	+ 85 29.4	+5 41 58.0	+56.18	- 11 58	+0.33137	0.94311
Quetta, Pakistan	1673	+30 07.2	+ 67 00.0	+4 28 00.0	+44.03	+ 62 00	+0.49901	0.86593
Rajkot	132	+22 10.8	+ 70 33.6	+4 42 14.0	+46 .36	+ 47 46	+0.37518	0.92646
Rawalpindi, Pakistan	510	+33 22.2	+ 73 03.6	+4 52 14.0	+48.01	+ 37 46	+0.54696	0.83605
Rome (Obs.), Italy	152	+41 33.0	+ 12 16.8	+0 49 07.2	+ 8.07	.. ..	+0.65982	0.74950
San Fernando (Naval Obs.), Spain	27	+36 28.0	- 6 12.2	-0 24 48.8	- 4.08	.. ..	+0.59108	0.80516
Shillong	1500	+25 20.4	+ 91 33.6	+6 06 14.0	+61.16	- 36 14	+0.42549	0.90455

1 metre = 3.2808 feet

LATITUDE AND LONGITUDE OF PLACES

Place	Altitude (Metre)	Latitude	Longitude In arc	Longitude In time	Reduction of Greenwich Sid. Time	Reduction of L.M.T. to Indian Standard Time	ρ sin φ′	ρ cos φ′
		° ′	° ′	h m s	s	m s		
Sholapur	476	+17 24.0	+ 75 33.6	+5 02 14	+49.65	+ 27 46	+0.29715	0.95460
Siliguri	127	+26 24.0	+ 88 13.2	+5 52 53	+57.97	- 22 53	+0.44196	0.89632
Simla	2202	+31 03.6	+ 77 07.8	+5 08 31	+50. 68	+ 21 29	+0.51312	0.85769
Singapore	18	+ 1 10.2	+103 30.6	+6 54 02	+68.02	.. ..	+0.02028	0.99980
Srinagar	1586	+34 03.6	+ 74 30.6	+4 58 02	+48.96	+ 31 58	+0.55704	0.82953
St. Petersburg Univ. Obs., Russia	3	+59 56.5	+ 30 17.7	+2 01 11	+19.91	.. ..	+0.86189	0.50214
Tehran, Iran	1200	+35 24.6	+ 51 15.0	+3 25 00	+33.68	.. ..	+0.57630	0.81610
Tokyo (Hydrographic Obs.), Japan	41	+35 24.0	+138 27.0	+9 13 48	+90.98	.. ..	+0.57605	0.81605
Thiruvanantapuram	61	+ 8 17.4	+ 76 34.2	+5 06 17	+50.31	+ 23 43	+0.14323	0.98963
Udaipur (Solar Obs.)	301	+24 21.0	+ 73 25.2	+4 53 41	+48.24	+ 36 19	+0.40980	0.91161
Udhagamandalam (Ooty) (Rad. Astr.Centre)	2150	+11 22.9	+ 76 40.0	+5 06 40	+50.38	+ 23 20	+0.19611	0.98079
Ujjain	496	+23 06.3	+ 75 28.2	+5 01 53	+49.59	+ 28 07	+0.39002	0.92033
Varanasi	76	+25 10.8	+ 83 00.0	+5 32 00	+54.54	- 2 00	+0.42288	0.90554
Visakhapatnam	38	+17 25.8	+ 83 08.4	+5 32 34	+54.63	- 2 34	+0.29763	0.95438
Washington (U. S. Naval Obs.), U.S.A.	92	+38 33.0	- 77 02.4	- 5 08 10	-50.62	.. ..	+0.61984	0.78309
Yangon, Myanmar	28	+16 27.0	+ 96 7.20	+6 24 29	+63.16	- 54 29	+0.28136	0.95933

1 metre = 3.2808 feet

SEMI-DIURNAL AND SEMI-NOCTURNAL ARCS

(FOR TRUE ALTITUDE = 0)

Lat. / Decli.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
º '	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
0 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00
5 00	6 00	6 04	6 07	6 12	6 14	6 17	6 20	6 24	6 26	6 28	6 30	6 32	6 35
10 00	6 00	6 07	6 15	6 23	6 28	6 34	6 41	6 49	6 52	6 56	7 01	7 06	7 11
15 00	6 00	6 11	6 22	6 36	6 43	6 52	7 02	7 14	7 20	7 27	7 34	7 42	7 51
20 00	6 00	6 15	6 30	6 49	6 59	7 11	7 25	7 43	7 51	8 00	8 11	8 22	8 36
23 00	6 00	6 18	6 36	6 58	7 11	7 25	7 43	8 05	8 15	8 27	8 40	8 56	9 15
25 00	6 00	6 19	6 39	7 02	7 16	7 32	7 51	8 15	8 27	8 40	8 55	9 13	9 35
28 00	6 00	6 22	6 45	7 12	7 27	7 46	8 08	8 37	8 52	9 08	9 28	9 59	10 28
30 00	6 00	6 23	6 49	7 18	7 35	7 56	8 21	8 54	9 11	9 30	9 55	10 30	12 00

When the latitude of the place and the declination of the heavenly body are of the same sign then the figure represent semi-diurnal arc, when of opposite signs then semi-nocturnal arc.

AMPLITUDE OF RISING AND SETTING

(FOR TRUE ALTITUDE = 0)

Lat. / Decli.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
º '	º '	º '	º '	º '	º '	º '	º '	º '	º '	º '	º '	º '	º '
0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
5 00	5 00	5 05	5 19	5 47	6 06	6 32	7 05	7 48	8 08	8 32	8 58	9 28	10 02
10 00	10 00	10 09	10 39	11 34	12 14	13 06	14 13	15 40	16 23	17 11	18 05	19 08	20 19
15 00	15 00	15 14	15 59	17 23	18 25	19 45	21 28	23 45	24 52	26 07	27 34	29 14	31 10
20 00	20 00	20 19	21 21	23 16	24 41	26 31	28 56	32 09	33 45	35 35	37 42	40 12	43 10
23 00	23 00	23 50	25 03	27 21	29 04	31 18	34 15	38 15	40 16	42 37	45 22	48 40	52 44
25 00	25 00	25 25	26 44	29 13	31 04	33 29	36 42	41 06	43 21	45 58	49 06	52 54	57 42
28 00	28 00	28 28	29 58	32 50	34 58	37 48	41 36	46 55	49 41	53 00	57 06	62 22	69 52
30 00	30 00	30 31	32 09	35 16	37 37	40 45	45 00	51 04	54 18	58 17	63 24	70 39	90 00

The amplitude of rising and setting points of a heavenly body is measured from the East or the West point of the horizon towards the northern or southern direction as the case may be. The amplitude is of the same sign as that of declination of the body.

Note - If true zenith distance of the heavenly body at the time of rising or setting be 90º + *h*, then the figures of the above two tables would require some correction according to the value of *h* (vide Explanation).

AUGMENTATION OF MOON'S SEMI-DIAMETER

Moon 's Apparent Altitude

Semi-diameter	0º	6º	12º	18º	24º	30º	36º	42º	48º	54º	60º	66º	72º	78º	84º	90º
′ ″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″
14 30	0.1	1.5	2.9	4.3	5.6	6.9	8.1	9.2	10.2	11.1	11.8	12.5	13.0	13.4	13.6	13.7
15 00	0.1	1.6	3.1	4.6	6.0	7.3	8.6	9.8	10.9	11.8	12.7	13.4	13.9	14.3	14.6	14.6
15 30	0.1	1.7	3.3	4.9	6.4	7.9	9.2	10.5	11.6	12.7	13.5	14.3	14.9	15.3	15.6	15.6
16 00	0.1	1.9	3.6	5.2	6.8	8.4	9.8	11.2	12.4	13.5	14.4	15.2	15.9	16.3	16.6	16.7
16 30	0.2	2.0	3.8	5.6	7.3	8.9	10.5	11.9	13.2	14.4	15.4	16.2	16.9	17.4	17.6	17.7
17 00	0.2	2.1	4.0	5.9	7.7	9.5	11.1	12.6	14.0	15.3	16.3	17.2	17.9	18.4	18.7	18.8

The visible or apparent semi-diameter of the moon is augmented over the tabulated value due to moon's altitude above the horizon.

NATURAL TRIGONOMETRIC FUNCTIONS

ANGLE		Sin	Cos	Tan	Cot	Sec	Cosec		
Arc	Time								
°	h m							h m	°
0	0 00	0.00000	1.00000	0.00000	Infinity	1.00000	Infinity	6 00	90
1	0 04	.01745	0.99985	.01746	57.28996	.00015	57.29869	5 56	89
2	0 08	.03490	.99939	.03492	28.63625	.00061	28.65371	5 52	88
3	0 12	.05234	.99863	.05241	19.08114	.00137	19.10732	5 48	87
4	0 16	.06976	.99756	.06993	14.30067	.00244	14.33559	5 44	86
5	0 20	.08716	.99619	.08749	11.43005	.00382	11.47371	5 40	85
6	0 24	.10453	.99452	.10510	9.51436	.00551	9.56667	5 36	84
7	0 28	.12187	.99255	.12278	8.14435	.00751	8.20551	5 32	83
8	0 32	.13917	.99027	.14054	7.11537	.00983	7.18530	5 28	82
9	0 36	.15643	.98769	.15838	6.31375	.01247	6.39245	5 24	81
10	0 40	.17365	.98481	.17633	5.67128	.01543	5.75877	5 20	80
11	0 44	0.19081	0.98163	0.19438	5.14455	1.01872	5.24084	5 16	79
12	0 48	.20791	.97815	.21256	4.70463	.02234	4.80973	5 12	78
13	0 52	.22495	.97437	.23087	4.33148	.02630	4.44541	5 08	77
14	0 56	.24192	.97030	.24933	4.01078	.03061	4.13357	5 04	76
15	1 00	.25882	.96593	.26795	3.73205	.03528	3.86370	5 00	75
16	1 04	.27564	.96126	.28675	3.48741	.04030	3.62796	4 56	74
17	1 08	.29237	.95630	.30573	3.27085	.04569	3.42030	4 52	73
18	1 12	.30902	.95106	.32492	3.07768	.05146	3.23607	4 48	72
19	1 16	.32557	.94552	.34433	2.90421	.05762	3.07155	4 44	71
20	1 20	.34202	.93969	.36397	2.74748	.06418	2.92380	4 40	70
21	1 24	0.35837	0.93358	0.38386	2.60509	1.07115	2.79043	4 36	69
22	1 28	.37461	.92718	.40403	2.47509	.07853	2.66947	4 32	68
23	1 32	.39073	.92050	.42447	2.35585	.08636	2.55930	4 28	67
24	1 36	.40674	.91355	.44523	2.24604	.09464	2.45859	4 24	66
25	1 40	.42262	.90631	.46631	2.14451	.10338	2.36620	4 20	65
26	1 44	.43837	.89879	.48773	2.05030	.11260	2.28117	4 16	64
27	1 48	.45399	.89101	.50953	1.96261	.12233	2.20269	4 12	63
28	1 52	.46947	.88295	.53171	1.88073	.13257	2.13005	4 08	62
29	1 56	.48481	.87462	.55431	1.80405	.14335	2.06267	4 04	61
30	2 00	.50000	.86603	.57735	1.73205	.15470	2.00000	4 00	60
31	2 04	0.51504	0.85717	0.60086	1.66428	1.16663	1.94160	3 56	59
32	2 08	.52992	.84805	.62487	1.60033	.17918	1.88708	3 52	58
33	2 12	.54464	.83867	.64941	1.53987	.19236	1.83608	3 48	57
34	2 16	.55919	.82904	.67451	1.48256	.20622	1.78829	3 44	56
35	2 20	.57358	.81915	.70021	1.42815	.22077	1.74345	3 40	55
36	2 24	.58779	.80902	.72654	1.37638	.23607	1.70130	3 36	54
37	2 28	.60182	.79864	.75355	1.32704	.25214	1.66164	3 32	53
38	2 32	.61566	.78801	.78129	1.27994	.26902	1.62427	3 28	52
39	2 36	.62932	.77715	.80978	1.23490	.28676	1.58902	3 24	51
40	2 40	.64279	.76604	.83910	1.19175	.30541	1.55572	3 20	50
41	2 44	0.65606	0.75471	0.86929	1.15037	1.32501	1.52425	3 16	49
42	2 48	.66913	.74314	.90040	1.11061	.34563	1.49448	3 12	48
43	2 52	.68200	.73135	.93252	1.07237	.36733	1.46628	3 08	47
44	2 56	.69446	.71934	0.96569	1.03553	.39016	1.43956	3 04	46
45	3 00	0.70711	0.70711	1.00000	1.00000	1.41421	1.41421	3 00	45
		Cos	Sin	Cot	Tan	Cosec	Sec	Time	Arc
								ANGLE	

STANDARD TIMES

LOCAL STANDARD TIME FOR EACH COUNTRY OR AREA
THE AHEAD OF (+) OR BEHIND (-) U.T. OR G.M.T

Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.		Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.	
	h	h	m		h	h	m
Aden	+ 3	15	00	Belgium	+ 1	13	00
Afghanistan	+ 4 1/2	16	30	Belize	- 6Ψ	06	00Ψ
Alaska	-9	03	00	Bermuda	- 4	08	00
- Day light Saving Time	- 8	04	00	Bhutan	+ 6	18	00
Albania	+ 1	13	00	Bolivia	- 4	08	00
- Day light Saving Time	+ 2	14	00	Brazil-			
Aleutian Islands	- 10	02	00	Eastern (including coast)	- 3*	09	00*
Algeria	0	12	00	Western	- 3*	09	00*
Angola	+ 1	13	00	Territory of Acre	- 4*	08	00*
Argentina	- 3	09	00	Bulgaria	+ 2	14	00
Ascension Islands	0	12	00	Cambodia	+ 7	19	00
Australia-				Cameroon	+ 1	13	00
Capital Territory (Canberra), Victoria, New South Wales, Queensland, Tasmania.	+ 10	22	00	Canada- Newfoundland	- 3 1/2*	08	30*
South Australia, Northern Territory, Broken Hill Area	+ 9 1/2	21	30	East of Long. 63° W N W Territories (East of Long. 68° W), New Brunswick Nova Scotia, Prince Edward Island	- 4*	08	00*
- Day light Saving Time	+ 10 1/2	22	30				
Western Australia	+ 8	20	00	Quebec (West of Long.63°W), Ontario (East of Long 90° W) (Ottawa), Nunavut (East) and NW Territories (Long.. W 68°-85°)	- 5*	07	00*
- Day light Saving Time	+ 9	21	00				
Austral Islands	- 10	02	00	Ontario (West of Long. 90° W), Manitoba, NW Territories (Long. W 85°-102°), East Saskatchewan, Nunavut (Central)	- 6*	06	00*
Austria	+ 1	13	00	Alberta	- 7*	05	00*
Azores	- 1	11	00	Yukon Time	- 8	04	00
Bahrain	+ 3	15	00	Canary Island	+ 1	13	00
Bangladesh	+ 6	18	00	Cape Verde Islands	- 1	11	00

STANDARD TIMES

LOCAL STANDARD TIME FOR EACH COUNTRY OR AREA
THE AHEAD OF (+) OR BEHIND (-) U.T. OR G.M.T

Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.		Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.	
	h	h	m		h	h	m
Caroline Islands-	+ 11	23	00	Ghana	0	12	00
Truk, Ponape	+ 11	23	00	Gibraltar	+ 1↓	13	00↓
Central African Republic	+ 1	13	00	Greece	+ 2	14	00
Chile	- 4*	08	00*	Greenland			
China, People's Republic of	+ 8	20	00	Angmagssalik, W. Coast	- 3	09	00
Cocos-keeling Islands	+ 6 1/2	18	30	Thule Area	- 4	08	00
Colombia	- 5	07	00	Guam	+ 10	22	00
Congo Republic	+ 1	13	00	Guatemala	- 6	06	00
Cook Islands	- 10	02	00	Guiana			
				Dutch (Surinam)	- 3	09	00
Corsica	+ 1↓	13	00↓	French	- 3	09	00
Costa Rica	- 6	06	00	Guyana Republic	- 4	08	00
Croatia	+1	13	00	Haiti	- 5	07	00
Cuba	- 5*	07	00*	Hawaiian Islands	- 10	02	00
Czech Republic	+1	13	00	Honduras	- 6	06	00
Cyprus	+ 2	14	00	Hong Kong	+ 8*	20	00*
Dahomey Republic (Africa)	+ 1	13	00	Hungary	+ 1	13	00
Denmark	+ 1	13	00	Iceland	0	12	00
Ecuador	- 5	07	00	India	+ 5 1/2	17	30
Egypt	+ 2*	14	00*	Indonesia, Republic of-	--	--	
Estonia	+ 2	14	00	Sumatra, Java, West & Central Kalimantan	+ 7	19	00
El Salvador	- 6	06	00	Bali, South & East Kalimantan	+ 8	20	00
Ethiopia	+ 3	15	00	Irian Jaya, Maluku	+ 9	21	00
Falkland Islands	-4	08	00	Iran	+ 3 1/2	15	30
Fiji	+12	24	00	Iraq	+ 3	15	00
Finland	+2	14	00	Ireland, Republic of	0	12	00
France	+1↓	13	00↓	Israel	+2	14	00
Germany	+1	13	00	Italy	+1*	13	00*

STANDARD TIMES

LOCAL STANDARD TIME FOR EACH COUNTRY OR AREA
THE AHEAD OF (+) OR BEHIND (-) U.T. OR G.M.T

Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.		Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.	
	h	h	m		h	h	m
Ivory Coast	0	12	00	Monaco	+ 1	13	00
Japan (and Japan Is.)	+ 9	21	00	Mongolia	+ 8	20	00
Jordan	+ 2	14	00	Morocco	0*	12	00*
Kenya	+ 3	15	00	Mozambique	+ 2	14	00
Korea (North & South)	+ 9	21	00	Nepal	+ 5 3/4	17	45
Kuwait	+ 3	15	00	Netherlands (Holland)	+ 1	13	00
Laos	+ 7	19	00	New Caledonia	+ 11	23	00
Latvia	+ 2	14	00	New Hebrides	+ 11	23	00
Lebanon	+ 2*	14	00*	New Zealand	+ 12	24	00
Liberia	0	12	00	Nicaragua	- 6	06	00
Libya	+ 2	14	00	Niger	+ 1	13	00
Lithuania	+ 3	15	00	Nigeria	+ 1	13	00
Luxembourg	+ 1↓	13	00↓	Norfolk Island	+ 11 1/2	23	30
Madagascar	+ 3	15	00	Norway	+ 1*	13	00*
Madeira	- 1*	11	00*	Oman (Masira, Muscat, Salalah)	+ 4	16	00
Malawi	+ 2	14	00	Pakistan	+ 5	17	00
Malaysia	+ 8	20	00	Papua New Guinea	+ 10	22	00
Maldives Island	+ 5	17	00	Paraguay	- 4	08	00
Malta	+ 1	13	00	Peru	- 5	07	00
Manchuria (China)	+ 8	20	00	Philippines	+ 8	20	00
Mariana Island	+ 10	22	00	Poland	+ 1*	13	00*
Marquesas Islands	- 9 1/2	02	30	Portugal	+ 1	13	00
Marshall Islands	+ 12	24	00	Puerto Rico	- 4	08	00
Mauritania	0	12	00	Reunion	+ 4	16	00
Mauritius	+ 4	16	00	Romania	+ 2	14	00
Mayanmar	+ 6 1/2	18	30	Sakhalin	+ 11	23	00
Mexico-				Samoa	- 11	01	00
Mexico City	- 6	06	00	Sardinia	+ 1	13	00
Sonora, Sinaloa, Nayarit, Baja California Sur	- 7	05	00				
Baja California	- 8	04	00				

STANDARD TIMES

LOCAL STANDARD TIME FOR EACH COUNTRY OR AREA
THE AHEAD OF (+) OR BEHIND (-) U.T. OR G.M.T

Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.		Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.	
	h	h	m		h	h	m
Saudi Arabia-				Tangier	0	12	00
Jeddah	+ 3	15	00	Thailand	+ 7	19	00
Dhahran	+ 4	16	00	Uganda	+ 3	15	00
Senegal	0	12	00	Ukraine	+ 2	14	00
Serbia	+ 1	13	00	United Arab Emirates	+ 4	16	00
Sierra Leone	0	12	00	USA Aleutian	- 10*	02	00*
Singapore	+ 8	20	30	USA Hawaii	- 10*	02	00*
Solomon Islands	+ 11	23	00	USA Pacific	- 8*	04	00*
Somalia	+ 3	15	00	USA Mountain	- 7*	05	00*
South Africa	+ 2	14	00	USA Arizona	- 7*	05	00*
Spain	+ 1↓	13	00↓	USA Central	- 6*	06	00*
Sri Lanka	+ 5 1/2	17	30	USA Eastern	- 5*	07	00*
Sudan	+ 2	14	00	Uruguay	- 3	09	00
Sweden	+ 1	13	00	Uzbekistan	+ 5	17	00
Switzerland	+ 1	13	00	Zambia	+ 2	14	00
Syria	+ 2*	14	00*	Zimbabwe	+ 2	14	00
Tanzania	+ 3	15	00				

* During summer seasons clock time differs from Standard time.
Ψ Winter time may be kept in these countries.
↓ This time is used throughout the year, but may differ from legal time.

PART - VI

INDIAN CALENDAR
AND
EXPLANATION

INDIAN CALENDAR
EXPLANATORY NOTE

The astronomical data included in this section on Indian Calendar have been calculated in accordance with the recommendations of the Calendar Reform Committee, as outlined in its report, and the calculations have been done on the basis of the positions of the Sun, Moon and Planets, as contained in the main tables of the Ephemeris. However, the information on Luni- Solar Calendar in this section have been calculated on the basis of traditional Nirayana Calendric system following the Government's decision not to disturb the traditional procedure in fixing the days of religious festivals. Certain additional data, which are required for the compilation of an Indian Panchang (Almanac), have also been furnished to meet the requirements of the numerous Panchang makers of this country. The tables of this section have been extended beyond December, 2020 and materials up to April 20, 2021 have been furnished in order to facilitate preparation of Almanacs for one complete Indian year. The longitudes of the Sun, Moon and Planets and certain other data relating to their positions for the period of 2021 covered by this calendar have also been given in separate table for the same purpose.

All calculations contained in this section have been done for an adopted Central Station of India situated at $82^0 30'$ longitude East of Greenwich and $23^0 11'$ latitude North (latitude of Ujjain) and accordingly the timings have been expressed in the local mean time of this Central Station, which is also the Indian Standard Time. This time (I.S.T.) is $5^h 30^m$ ahead on the Universal Time or Greenwich Mean Time.

The Calendar used in this section is the 'National Calendar' of India as recommended by the Calendar Reform Committee and introduced by the Government of India with effect from the 22 nd March 1957, corresponding to the 1^{st} of Chaitra, 1879 Saka Era. Thereafter, Govt. of India has decided to introduce an all India Nirayana Solar Calendar in addition to the existing National Calendar. This new Calendar has been introduced with effect from 14th April, 2004 corresponding to 1st Vaisakha of 5105 Kali, Kali Era being the Era of this new Calendar and this Calendar have fixed number of days for its months. Dates of the Nirayana Calendar have been indicated in addition to the existing National Calendar. The months of these Calendars, the number of days assigned to each month of the two Calendars, and the dates of the Gregorian calendar corresponding to the first day of each month of both the Calendars are as follows :-

Months of the National Calendar	Gregorian date for 1st of the month	Months of the Nirayana Calendar	Gregorian date for 1st of the month
Chaitra (30 days ; 31 days in a leap-year)	March 22 (March 21 in a leap-year)	Vaisakha (31 days)	April 14
		Jyaishtha (31 days)	May 15
Vaisakha (31 days)	April 21	Ashadha (31 days)	June 15
Jyaishtha (31 days)	May 22	Sravana (31 days)	July 16
Ashadha (31 days)	June 22	Bhadra (31 days)	August 16
Sravana (31 days)	July 23	Asvina (30 days)	September 16
Bhadra (31 days)	August 23	Kartika (30 days)	October 16
Asvina (30 days)	September 23	Agrahayana (30 days)	November 15
Kartika (30 days)	October 23	Pausha (30 days)	December 15
Agrahayana (30 days)	November 22	Magha (30 days)	January 14
Pausha (30 days)	December 22	Phalguna (30 days ; 31 days in a leap-year)	February 13
Magha (30 days)	January 21		
Phalguna (30 days)	February 20	Chaitra (30 days)	March 15

Different items included in this section are elaborated below :-

The Sunrise and Sunset times, calculated for the Central Station, relate respectively to the appearance and disappearance of the upper limb of the Sun on the horizon. The amount of horizontal refraction taken for this purpose is $31'$ and the semi-diameter of the Sun as $16'$, so that at the given times of Sunrise and Sunset, the centre of the Sun actually $47'$ below the horizon.

The apparent noon is the local mean time of the sun's meridian passage, i.e., the mid-day reduced to the above standard meridian of India ($82\frac{1}{2}^0$ E. Longitude).

INDIAN CALENDAR

The ending moments of tithis, nakshatras and yogas have been given in Indian Standard Time and shown against their ordinal numbers. The phenomena being geocentric ones, their timings in I.S.T. are applicable for the whole of India without any modification. These timings reduced by a deduction of $5^h\ 30^m$ would give the G.M.T. applicable for all places on the earth.

The tithi is based on the difference of longitude of the Moon and that of the Sun. A tithi is completed when the longitude of the Moon gains exactly 12^0 or its integral multiple on that of the Sun and as such there are 30 tithis in lunar month. A difference in longitude of 12^0 indicates the ending of the 1st tithi, 24^0 that of the 2nd tithi and so on. The number of tithis have been shown from Sukla 1 to Sukla 15 (full-moon) and again from Krishna 1 to Krishna 14 and Krishna 30 (new moon), using the symbols S and K for Sukla paksha (waxing Moon)and Krishna paksha (waning Moon) respectively.

A nakshatra is completed when the nirayana longitude of the Moon as measured from the initial point attains a value of $13°\ 20'$ or an integral multiple thereof. When this longitude is $13°\ 20'$ the 1st nakshatra ends and so on. There are thus 27 nakshatras in a sidereal month and the nakshatra divisions occupy fixed positions in the sphere of stars. In the case of the Sun the calculation also has been done on the same basis. But in this case, the time of Sun's entry into a nakshatra-division has been stated, whereas in the case of the Moon, the time of its exit from the division has been given.

Like nakshatras, there are 27 yogas. Yoga is calculated from the sum of nirayana longitudes of the Sun and the Moon. When the sum amounts to $13°\ 20'$, the first yoga ends; when it amounts to $26°\ 40'$, the second yoga ends, and so on. Thus, in all 27 yogas cover 360°. Names of the nakshatras and yogas have been given at the bottom of the table. It will be seen that two of the names Vyatipata and Vaidhriti occur also under Phenomena, where they have been treated as special yogas and calculated by a somewhat different rule. The 27 yogas which have got very little astronomical significance have been included in this publication only to meet the needs of Panchang where the yoga is also one of the components.

For the purpose of calculation of rasis, nakshatras and yogas, an initial point which occupies a fixed position on the ecliptic has been adopted as the origin for the measurement of longitudes. The position of this initial point coincides with the vernal equinoctial point of vernal equinox day of 285 A.D. For the purpose of assigning a precise position to it, the tropical longitude of this initial point has been adopted as $23°\ 15'\ 00''$ for 0^h on 21st March, 1956. The tropical longitude of this fixed initial point for any day is known as ayanamsa. The longitude of a celestial body measured from this initial point is known as nirayana longitude.

The entry into different rasis of the Moon and of the Sun have been shown at the bottom of the relevant pages of the calendar and the calculations have been done on the same basis as in the case of nakshatras, utilising the nirayana longitudes. Rasis, which cover arc of 30^0 of the zodiac belt, are measured along the ecliptic from the above-mentioned initial point.

The tithi, nakshatra and yoga as are current at Sunrise at the Central Station, have been shown against the date with their ending moments in I. S. T. When the time of these or any other phenomena falls after midnight and before the next Sunrise, the time has been expressed after adding 24^h to the I.S.T. without changing the date after midnight in order to maintain continuity of time-reckoning from one Sunrise to the next, in conformity with the system followed in Indian religious calendars.

The solar months recommended for the religious calendar, such as, Saura Vaisakha, Saura Jyaishtha, etc., by the Calendar Reform Committee in 1955 have been reckoned from the moments when the apparent longitude of the Sun equals $23°\ 15'$, $53°\ 15'$ and so on. The calculation for this purpose thus has not been done with a variable ayanamsa, as in the case of rasis and nakshatras, but with a fixed ayanamsa of $23°\ 15'$. These months are shown for purpose of illustration only, but are not used in practice for actual luni-solar adjustment.

INDIAN CALENDAR

The lunar months for determining the dates of religious festivals are reckoned from one New-Moon to the next (Sukladi system or mukhya mana). The lunar month for this purpose is named after the Nirayana or Sidereal solar month in which the initial New-Moon from which the month starts, falls.

Phenomena mentioned in the table include New-Moon, Full-Moon, Sayana Vyatipata (when the sum of the tropical longitudes of the Sun and the Moon equals 180^0), Sayana Vaidhriti (when the above sum amounts to 360^0), eclipses, heliacal rising and setting of Venus, Mars and Jupiter and Jupiter's transit into rasis.

The principal festivals of different states have been fixed on the basis of the criterion stated here, but in doing so, the rules and conventions of the states concerned have been followed as far as practicable.

LIST OF HOLIDAYS

The list of holidays for the Government of India as well as for the State Governments have been prepared in a consolidated form and the dates fixed for them, have been shown in a separate table under the head 'Principal Festivals for Holidays'. The principal festivals of Moslems, Parsis, Jewish and Christians have also been shown separately.

AYANAMSA

The value of ayanamsa has been given in the calendar for the first day of the month and also in a separate table at the end at interval of three days.

The Sayana Vyatipata and Sayana Vaidhriti, reported under the column "Phenomena", are calculated on the basis of defination given in the report of Calendar Reform Committee. These are classified as the Calendar Reform Committee view and no way related to the 'mahapata yoga' defined in some Indian traditional texts (siddhantic treatises).

HELIACAL RISING AND SETTING OF PLANETS, 2021
(JANUARY TO APRIL)

Planet	National Date		Nirayana Date		Gregorian Date		Time (I.S.T) h	m
Mercury rises in the West	Pausha	17, 1942 Saka	Pausha	24, 5121 Kali	Jan.	7, 2021	11	36
Mercury sets in the West	Magha	14, 1942 Saka	Magha	21, 5121 Kali	Feb.	3, 2021	23	18
Mercury rises in the East	Magha	24, 1942 Saka	Phalguna	1, 5121 Kali	Feb.	13, 2021	14	04
Mercury sets in the East	Chaitra	10, 1943 Saka	Chaitra	17, 5121 Kali	Mar.	31, 2021	25	52
Venus sets in the East	Magha	28, 1942 Saka	Phalguna	5, 5121 Kali	Feb.	17, 2021	10	10
Venus rises in the West	Chaitra	18, 1943 Saka	Vaisakha	5, 5122 Kali	Apr.	19, 2021	5	41
Jupiter sets in the West	Pausha	26, 1942 Saka	Magha	3, 5121 Kali	Jan.	16, 2021	26	45
Jupiter rises in the East	Magha	23, 1942 Saka	Magha	30, 5121 Kali	Feb.	12, 2021	10	06
Saturn sets in the West	Pausha	19, 1942 Saka	Pausha	26, 5121 Kali	Jan.	9, 2021	15	37
Saturn rises in the East	Magha	20, 1942 Saka	Magha	27, 5121 Kali	Feb.	9, 2021	26	00

N.B.- Here East means the eastern horizon or west of the Sun and West means the western horizon or east of the Sun.

RETROGRESSION OF PLANETS, 2021
(JANUARY TO APRIL)

Planet		National Date		Nirayana Date		Gregorian Date		Time (I.S.T) h	m
Mercury	Retrograde	Magha	10, 1942 Saka	Magha	17, 5121 Kali	Jan.	30, 2021	21	19
Mercury	Direct	Phalguna	2, 1942 Saka	Phalguna	9, 5121 Kali	Feb.	21, 2021	6	35
Uranus	Direct	Pausha	24, 1942 Saka	Magha	1, 5121 Kali	Jan.	14, 2021	14	08

MEAN RAHU, 2021

Date		Longitude ° ′ ″	Date		Longitude ° ′ ″	Date		Longitude ° ′ ″
Jan.	-2	54 52 17	Feb.	7	52 45 06	Mar.	19	50 37 55
	8	54 20 29		17	52 13 18		29	50 06 07
	18	53 48 41		27	51 41 30	Apr.	8	49 34 20
Jan.	28	53 16 54	Mar.	9	51 09 43		18	49 02 32
							28	48 30 44

ECLIPSES, 2021
(JANUARY TO APRIL)

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INDIAN CALENDAR

SAKA ERA 1941

Makara : Tapas
Winter (Sisira), 1st Month

Month of PAUSHA (30 days)

(*Nirayana*) 8 Pausha, 5120 Kali Era to (*Nirayana*) 7 Magha, 5120 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi			Nakshatra			Yoga		
									No.	Ending Moment		No.	Ending Moment		No.	Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2019 A.D.															
1	Sun	Dec. 22	6	37.3	11	58.3	17	19.5	K 11	15	22.4	15	18	37.7	6	8	39.0
															(7	30	00.6)
2	Mon	23	6	37.8	11	58.8	17	20.0	12	13	42.0	16	17	39.6	8	27	34.6
3	Tue	24	6	38.3	11	59.3	17	20.5	13	12	18.8	17	16	59.1	9	25	24.5
4	Wed	25	6	38.7	11	59.8	17	21.1	14	11	17.6	18	16	41.1	10	23	33.7
5	Thu	26	6	39.2	12	00.3	17	21.6	K 30	10	43.1	19	16	50.1	11	22	05.6
6	Fri	27	6	39.6	12	00.8	17	22.2	S 1	10	39.7	20	17	30.0	12	21	02.7
7	Sat	28	6	40.0	12	01.3	17	22.8	2	11	10.2	21	18	43.1	13	20	26.4
8	Sun	29	6	40.4	12	01.8	17	23.4	3	12	15.9	22	20	29.7	14	20	16.4
9	Mon	30	6	40.7	12	02.3	17	24.0	4	13	54.8	23	22	46.6	15	20	30.4
10	Tue	31	6	41.1	12	02.7	17	24.6	S 5	16	01.7	24	25	27.6	16	21	03.8
		2020 A.D.															
11	Wed	Jan. 1	6	41.4	12	03.2	17	25.3	6	18	27.6	25	28	22.7	17	21	49.8
12	Thu	2	6	41.7	12	03.7	17	25.9	7	21	00.6	26	-	-	18	22	39.8
13	Fri	3	6	42.0	12	04.1	17	26.6	8	23	26.8	26	7	19.8	19	23	24.1
14	Sat	4	6	42.3	12	04.6	17	27.2	9	25	32.8	27	10	05.4	20	23	53.5
15	Sun	5	6	42.5	12	05.0	17	27.9	S 10	27	07.3	1	12	27.2	21	23	59.5
16	Mon	6	6	42.7	12	05.6	17	28.6	11	28	02.5	2	14	15.4	22	23	37.2
17	Tue	7	6	42.9	12	06.0	17	29.3	12	28	14.8	3	15	23.9	23	22	42.1
18	Wed	8	6	43.1	12	06.4	17	30.0	13	27	44.4	4	15	50.8	24	21	13.8
19	Thu	9	6	43.3	12	06.8	17	30.6	14	26	34.7	5	15	37.6	25	19	13.9
20	Fri	10	6	43.4	12	07.2	17	31.3	S 15	24	51.3	6	14	48.5	26	16	45.8
21	Sat	11	6	43.5	12	07.6	17	32.0	K 1	22	41.2	7	13	30.0	27	13	54.4
22	Sun	12	6	43.6	12	08.0	17	32.8	2	20	12.3	8	11	49.6	1	10	45.3
23	Mon	13	6	43.6	12	08.4	17	33.5	3	17	32.6	9	9	55.3	2	7	24.6
															(3	27	58.4)
24	Tue	14	6	43.7	12	08.7	17	34.2	4	14	49.7	10	7	55.2	4	24	32.6
												(11	29	56.8)			
25	Wed	15	6	43.7	12	09.1	17	34.9	K 5	12	10.7	12	28	06.8	5	21	12.3
26	Thu	16	6	43.7	12	09.6	17	35.6	6	9	41.8	13	26	30.6	6	18	02.1
27	Fri	17	6	43.6	12	10.0	17	36.3	7	7	28.2	14	25	12.6	7	15	05.5
									(8	29	33.7)						
28	Sat	18	6	43.6	12	10.2	17	37.0	9	28	01.0	15	24	15.6	8	12	24.9
29	Sun	19	6	43.5	12	10.5	17	37.8	K 10	26	51.6	16	23	41.2	9	10	02.2
30	Mon	20	6	43.4	12	10.8	17	38.5	K 11	26	06.2	17	23	30.3	10	7	58.0
															(11	30	12.9)

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

Uttarayana — SAKA ERA 1941
Dakshina Gola — Month of PAUSHA (30 days) — Ayanamsa on 1st : 24° 07′ 53″

(*Nirayana*) 8 Pausha, 5120 Kali Era to (*Nirayana*) 7 Magha, 5120 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2019 A.D.					
1	Dec. 22	SAURA PAUSHA	CHAANDRA MARGASHIRSHA	1- Enters Tropical Capricornus ($9^h 49^m.4$)		1- Uttarayana day, Saphala Ekadasi.
2	23					
3	24					
4	25				4- Sayana Vyatipata ($20^h 56^m.8$)	4- Birthday of Sadhu T. L.Vaswani (Sindhi),Vakula Amavasya (Odisha).
5	26				5- New Moon ($10^h 43^m.1$)	5- Jor Mela- 3 days (Punjab).
6	27		CHAANDRA PAUSHA		5- Solar Eclipse (visible in India)	
7	28					
8	29			8- Enters Purvashadha nak. ($17^h 36^m.1$)		
9	30					
10	31					
	2020A.D.					
11	Jan. 1					
12	2					12- Guru Govind Singh's Birthday (according to tithi).
13	3					
14	4					
15	5					15- Samba Dasami (Odisha).
16	6					16- Putrada ekadasi,Vaikuntha Ekadasi (S India).
17	7					
18	8				18- Jupiter rises in the East ($30^h 33^m$) 18- Sayana Vaidhriti ($7^h 19^m.0$)	
19	9					
20	10				20- Full Moon ($24^h 51^m.3$)	20- Arudra Darshanam (Purvarunodaya) (S. India), Paushi Purnima, Pushyabhisheka Yatra.
21	11			21- Enters Uttarashadha nak. ($19^h 35^m.5$)		
22	12					
23	13			23- Saura Maghadi ($29^h 20^m.3$)		23- Lohri (Punjab,J&K), Ganesha Sankashta Chaturthi.
24	14					24- Bhogi(S. India), Birthday of Sant Paramanand (Sindhi).
25	15	SAURA MAGHA				25- Pongal (S. India), Makara Snana,Tila Samkranti, Tai Pongal(Kerala), Tamil New Year's Day, Magha Bihu (Assam), Makara Samkranti (N.India), Makara Samkranti.
26	16					26- Mattu Pongal or Kanuvu(S. India),
27	17					27- Birthday of Swami Vivekananda (according to tithi),Ashtaka (Mamashtaka).
28	18					
29	19				29- Sayana Vyatipata ($29^h 19^m.3$)	
30	Jan. 20			30- Enters Tropical Aquarius ($20^h 24^m.6$)		30- Sattila Ekadasi.

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Vrischika 2, $11^h 52^m.7$; Dhanus 4, $16^h 41^m.1$; Makara 6, $23^h 45^m.1$; Kumbha 9, $9^h 34^m.6$; Mina 11, $21^h 38^m.3$; Mesha 14, $10^h 05^m.4$; Vrisha 16, $20^h 36^m.4$; Mithuna 18, $27^h 49^m.1$; Karkata 21, $7^h 52^m.0$; Simha 23, $9^h 55^m.3$; Kanya 25, $11^h 28^m.3$; Tula 27, $13^h 49^m.2$; Vrischika 29, $17^h 47^m.6$; Sun enters :- Nirayana Makara 24, $26^h 08^m.1$.

INDIAN CALENDAR

SAKA ERA 1941

Kumbha : Tapasya

Month of MAGHA (30 days)

Winter (Sisira), 2nd Month

(*Nirayana*) 8 Magha, 5120 Kali Era to (*Nirayana*) 7 Phalguna, 5120 Kali Era

Date	Week Day	Gregorian Date		Sunrise		Apparent Noon		Sunset		Tithi No.		Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
				h	m	h	m	h	m			h	m		h	m		h	m
		2020 A.D.																	
1	Tue	Jan.	21	6	43.3	12	11.0	17	39.2	K	12	25	45.3	18	23	43.1	12	28	46.8
2	Wed		22	6	43.1	12	11.4	17	39.9		13	25	49.1	19	24	19.8	13	27	39.8
3	Thu		23	6	43.0	12	11.6	17	40.6		14	26	17.9	20	25	20.6	14	26	52.0
4	Fri		24	6	42.8	12	11.9	17	41.3	K	30	27	12.0	21	26	45.9	15	26	23.7
5	Sat		25	6	42.6	12	12.1	17	42.0	S	1	28	31.6	22	28	35.5	16	26	14.7
6	Sun		26	6	42.3	12	12.4	17	42.7		2	30	15.9	23	-	-	17	26	24.3
7	Mon		27	6	42.1	12	12.6	17	43.4		3	-	-	23	6	48.7	18	26	51.3
8	Tue		28	6	41.8	12	12.8	17	44.1		3	8	22.4	24	9	22.9	19	27	31.6
9	Wed		29	6	41.5	12	13.0	17	44.8		4	10	46.3	25	12	13.3	20	28	21.1
10	Thu		30	6	41.1	12	13.2	17	45.5	S	5	13	19.7	26	15	12.4	21	29	12.9
11	Fri		31	6	40.8	12	13.3	17	46.2		6	15	52.2	27	18	09.8	22	29	58.6
12	Sat	Feb.	1	6	40.4	12	13.5	17	46.8		7	18	11.2	1	20	53.5	23	30	29.4
13	Sun		2	6	40.0	12	13.6	17	47.5		8	20	04.1	2	23	11.2	24	30	36.5
14	Mon		3	6	39.6	12	13.7	17	48.2		9	21	19.6	3	24	52.3	25	30	12.7
15	Tue		4	6	39.1	12	13.8	17	48.8	S	10	21	50.0	4	25	49.2	26	29	12.9
16	Wed		5	6	38.7	12	13.9	17	49.5		11	21	31.3	5	25	58.5	27	27	34.9
17	Thu		6	6	38.2	12	14.0	17	50.1		12	20	23.9	6	25	20.9	1	25	19.3
18	Fri		7	6	37.7	12	14.0	17	50.7		13	18	31.9	7	24	00.6	2	22	29.1
19	Sat		8	6	37.2	12	14.1	17	51.3		14	16	02.1	8	22	05.0	3	19	09.8
20	Sun		9	6	36.6	12	14.2	17	52.0	S	15	13	03.2	9	19	43.2	4	15	28.0
21	Mon		10	6	36.1	12	14.2	17	52.6	K	1	9	45.2	10	17	05.7	5	11	31.6
											(2	30	18.5)						
22	Tue		11	6	35.5	12	14.2	17	53.2		3	26	53.3	11	14	23.2	6	7	28.7
																	(7	27	27.7)
23	Wed		12	6	34.9	12	14.2	17	53.8		4	23	39.8	12	11	46.3	8	23	36.5
24	Thu		13	6	34.3	12	14.2	17	54.3	K	5	20	46.8	13	9	24.9	9	20	02.1
25	Fri		14	6	33.7	12	14.2	17	54.9		6	18	21.5	14	7	27.6	10	16	50.1
														(15	30	00.9)			
26	Sat		15	6	33.0	12	14.1	17	55.5		7	16	29.6	16	29	09.0	11	14	04.8
27	Sun		16	6	32.4	12	14.1	17	56.1		8	15	14.2	17	28	53.6	12	11	48.4
28	Mon		17	6	31.7	12	14.0	17	56.6		9	14	35.9	18	29	13.7	13	10	01.4
29	Tue		18	6	31.0	12	13.9	17	57.2	K	10	14	33.1	19	30	06.4	14	8	42.6
30	Wed		19	6	30.3	12	13.9	17	57.7	K	11	15	02.6	20	-	-	15	7	49.5

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

Uttarayana — SAKA ERA 1941

Dakshina Gola — Month of MAGHA (30 days) — Ayanamsa on 1st : 24° 07′ 58″

(*Nirayana*) 8 Magha, 5120 Kali Era to (*Nirayana)* 7 Phalguna, 5120 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2020 A.D.					
1	Jan. 21	SAURA MAGHA	CHAANDRA PAUSHA			1- Martyrdom Day of Hemu Kalani (Sindhi).
2	22					2- Meru Trayodasi (Jain).
3	23					3- Netaji's Birthday, Ratanti Kalika Puja.
4	24			4- Enters Sravana nak. ($21^h 51^m.4$)	4- New Moon ($27^h 12^m.0$)	4- Mauni Amavasya, Tai Amavasya, Makara Vavu (Kerala).
5	25		CHAANDRA MAGHA			5- Magha Sukladi.
6	26					6- Republic Day.
7	27					
8	28					8- Birthday of Lala Lajpat Rai, Varada Chaturthi, Tila Chaturthi, Kunda Chaturthi, Ganesa Puja (Bengal).
9	29					
10	30					10- Martyr's Day (Mahatma Gandhi Commemoration Day), Vasanta Panchami, Sarasvati Puja, Sri Panchami.
11	31					
12	Feb. 1					12- Ratha Saptami (Purvarunodaya), Vidhana Saptami, Arogya Saptami.
13	2				13- Sayana Vaidhriti ($15^h 38^m.9$)	13- Bhismashtami.
14	3					
15	4					
16	5					16- Jaya Ekadasi, Bhaimi Ekadasi (Bengal).
17	6			17- Enters Dhanishtha nak. ($24^h 57^m.5$)		17- Bhishma Dvadasi.
18	7					18- Desert Festival- 3 days(Jaisalmer).
19	8					19- Floating Festival (Tai Poosam).
20	9				20- Full Moon ($13^h 03^m.2$)	20- Maghi Purnima, Guru Ravi Das's Birthday (according to tithi).
21	10					
22	11					
23	12			23- Saura Phalgunadi ($18^h 04^m.9$)		
24	13					
25	14	SAURA PHALGUNA			25- Sayana Vyatipata ($14^h 22^m.7$)	
26	15					26- Vaikkatashtami (Kerala)
27	16					27- Ashtaka (Sakashtaka), Janaki Janma.
28	17					
29	18					29- Birthday of Swami Dayananda Saraswati (Founder of Arya Samaj)(according to tithi).
30	Feb. 19			30- Enters Trop. Pisces ($10^h 27^m.0$) 30- Enters Satabhisaj ($29^h 29^m.7$)		30- Vijaya Ekadasi, Sivaji Jayanti.

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Dhanus 1, $23^h 43^m.1$; Makara 4, $7^h 39^m.6$; Kumbha 6, $17^h 39^m.3$; Mina 8, $29^h 29^m.5$; Mesha 11, $18^h 09^m.8$; Vrisha 13, $29^h 40^m.3$; Mithuna 16, $13^h 59^m.8$; Karkata 18, $18^h 24^m.3$; Simha 20, $19^h 43^m.2$; Kanya 22, $19^h 43^m.0$; Tula 24, $20^h 22^m.9$; Vrischika 26, $23^h 18^m.7$; Dhanus 28, $29^h 13^m.7$; Sun enters :- Nirayana Kumbha 24, $15^h 03^m.6$.

INDIAN CALENDAR

SAKA ERA 1941

Mina : Madhu

Month of PHALGUNA (30 days)

Spring (Vasanta), 1st Month

(*Nirayana*) 8 Phalguna, 5120 Kali Era to (*Nirayana)* 7 Chaitra, 5120 Kali Era

Date	Week Day	Gregorian Date		Sunrise		Apparent Noon		Sunset		Tithi No.	Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
				h	m	h	m	h	m		h	m		h	m		h	m
		2020 A.D.																
1	Thu	Feb.	20	6	29.6	12	13.8	17	58.2	K 12	16	00.1	20	7	27.7	16	7	18.9
2	Fri		21	6	28.8	12	13.7	17	58.8	13	17	21.5	21	9	13.4	17	7	07.7
3	Sat		22	6	28.1	12	13.6	17	59.3	14	19	03.2	22	11	19.4	18	7	12.9
4	Sun		23	6	27.3	12	13.4	17	59.8	K 30	21	02.0	23	13	42.7	19	7	32.0
5	Mon		24	6	26.5	12	13.3	18	00.3	S 1	23	15.4	24	16	20.7	20	8	03.2
6	Tue		25	6	25.7	12	13.1	18	00.8	2	25	40.2	25	19	10.4	21	8	44.5
7	Wed		26	6	24.9	12	13.0	18	01.8	3	28	12.2	26	22	08.1	22	9	33.4
8	Thu		27	6	24.1	12	12.8	18	01.8	4	-	-	27	25	08.2	23	10	26.4
9	Fri		28	6	23.3	12	12.7	18	02.3	4	6	44.9	1	28	02.7	24	11	18.9
10	Sat		29	6	22.4	12	12.5	18	02.7	S 5	9	09.8	2	-	-	25	12	04.3
11	Sun	Mar.	1	6	21.6	12	12.3	18	03.2	6	11	16.3	2	6	42.0	26	12	35.3
12	Mon		2	6	20.7	12	12.1	18	03.7	7	12	53.3	3	8	55.1	27	12	43.8
13	Tue		3	6	19.8	12	11.9	18	04.1	8	13	50.5	4	10	31.6	1	12	22.2
14	Wed		4	6	19.0	12	11.7	18	04.6	9	14	00.4	5	11	23.4	2	11	24.7
15	Thu		5	6	18.1	12	11.4	18	05.0	S 10	13	19.2	6	11	25.8	3	9	47.7
16	Fri		6	6	17.2	12	11.2	18	05.4	11	11	47.4	7	10	38.4	4	7	30.4
																(5	28	35.1)
17	Sat		7	6	16.3	12	11.0	18	05.9	12	9	29.2	8	9	04.9	6	25	06.3
18	Sun		8	6	15.3	12	10.7	18	06.3	13	6	31.7	9	6	52.2	7	21	10.9
										(14	27	04.2)	(10	28	09.8)			
19	Mon		9	6	14.4	12	10.5	18	06.7	S 15	23	17.7	11	25	08.8	8	16	57.2
20	Tue		10	6	13.5	12	10.2	18	07.1	K 1	19	23.7	12	22	01.5	9	12	34.3
21	Wed		11	6	12.6	12	10.0	18	07.5	2	15	33.9	13	18	59.9	10	8	11.5
																(11	27	58.3)
22	Thu		12	6	11.6	12	09.7	18	07.9	3	11	59.5	14	16	15.7	12	24	03.5
23	Fri		13	6	10.7	12	09.4	18	08.3	4	8	51.0	15	13	59.5	13	20	34.5
24	Sat		14	6	09.7	12	09.1	18	08.7	K 5	6	17.4	16	12	20.0	14	17	37.3
										(6	28	25.7)						
25	Sun		15	6	08.8	12	08.8	18	09.1	7	27	19.7	17	11	23.4	15	15	15.7
26	Mon		16	6	07.8	12	08.6	18	09.5	8	27	00.2	18	11	12.3	16	13	31.2
27	Tue		17	6	06.8	12	08.3	18	09.9	9	27	24.3	19	11	46.1	17	12	22.6
28	Wed		18	6	05.9	12	08.0	18	10.3	K 10	28	26.7	20	13	00.7	18	11	46.6
29	Thu		19	6	04.9	12	07.7	18	10.7	11	29	59.9	21	14	49.6	19	11	38.2
30	Fri		20	6	03.9	12	07.4	18	11.1	K 12	-	-	22	17	05.0	20	11	51.7

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1941

Uttarayana
Dakshina Gola

Month of PHALGUNA (30 days)

Ayanamsa on 1st : $24^{0} 08^{\prime} 02^{\prime\prime}$

(*Nirayana*) 8 Phalguna, 5120 Kali Era to (*Nirayana)* 7 Chaitra, 5120 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2020 A.D.					
1	Feb. 20	SAURA PHALGUNA	CHAANDRA MAGHA			1- Maha Sivaratri (Kashmir).
2	21					2- Maha Sivaratri, Sivaratri (S. India).
3	22					
4	23				4- New Moon ($21^h 02^m.0$)	
5	24		CHAANDRA PHALGUNA			
6	25					6- Birthday of Sri Ramakrishna (according to tithi).
7	26					
8	27				8- Sayana Vaidhriti ($19^h 53^m.1$)	
9	28					
10	29					
11	Mar. 1					
12	2					12- Holashtaka.
13	3					
14	4			14- Enters Purva Bhadrapada nak. ($11^h 42^m.6$)		
15	5					
16	6					16- Amlaki Ekadasi, Govinda Dvadasi.
17	7					
18	8					18- Masi Magham.
19	9				19- Full Moon ($23^h 17^m.7$)	19- Holikadahana, Birthday of Sri Chaitanya, Dolyatra.
20	10				20- Sayana Vyatipata ($29^h 49^m.8$)	20- Holi, Hola, Vasantotsava.
21	11					
22	12					
23	13			23- Saura Chaitradi ($14^h 36^m.0$)		23- Ranga Panchami.
24	14					24- Bijoy Govindaji Halangkar (Manipur).
25	15	SAURA CHAITRA				
26	16					26- Varsitaparambha (Jain), Sitalashtami.
27	17			27- Enters Uttara Bhadrapada nak. ($20^h 13^m.5$)		
28	18					
29	19			29- Enters Trop. Aries ($9^h 19^m.6$)		29- Papamochani Ekadasi (Smarta).
30	Mar. 20					30- Indian Year Ending day, Vanjuli Mahadvadasi, Mahavishuva day, Ekadasi (Vaishnava & Vidhava).
	1942 S.E.					
Chtr. 1	Mar. 21					1- Indian New Year's Day, MahaVaruni (after $19^h 40^m.0$).

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½^0 E. Long.

Moon enters :- Makara 1, $13^h 52^m.0$; Kumbha 3, $24^h 29^m.1$; Mina 6, $12^h 27^m.1$; Mesha 8, $25^h 08^m.2$; Vrisha 11, $13^h 18^m.2$; Mithuna 13, $23^h 03^m.5$; Karkata 15, $28^h 54^m.9$; Simha 18, $6^h 52^m.2$; Kanya 20, $6^h 22^m.1$; Tula 21, $29^h 34^m.8$; Vrischika 24, $6^h 41^m.0$; Dhanus 26, $11^h 12^m.3$; Makara 28, $19^h 25^m.0$; Sun enters: Nirayana Mina 24, $11^h 53^m.8$.

INDIAN CALENDAR

SAKA ERA 1942 — Mesha : Madhava

Month of CHAITRA(31 days) — Spring (Vasanta), 2nd Month

(*Nirayana*) 7 Chaitra, 5120 Kali Era to (*Nirayana*) 7 Vaisakha, 5121 Kali Era

Date	Week Day	Gregorian Date	Sunrise h	Sunrise m	Apparent Noon h	Apparent Noon m	Sunset h	Sunset m	Tithi No.	Tithi Ending Moment h	Tithi Ending Moment m	Nakshatra No.	Nakshatra Ending Moment h	Nakshatra Ending Moment m	Yoga No.	Yoga Ending Moment h	Yoga Ending Moment m
		2020 A.D.															
1	Sat	Mar. 21	6	03.0	12	07.1	18	11.4	K 12	7	56.2	23	19	39.5	21	12	21.5
2	Sun	22	6	02.0	12	06.8	18	11.8	13	10	08.4	24	22	26.6	22	13	02.4
3	Mon	23	6	01.0	12	06.5	18	12.2	14	12	30.6	25	25	21.1	23	13	50.5
4	Tue	24	6	00.0	12	06.2	18	12.6	K 30	14	58.2	26	28	18.9	24	14	42.6
5	Wed	25	5	59.1	12	05.9	18	12.9	S 1	17	27.3	27	-	-	25	15	36.0
6	Thu	26	5	58.1	12	05.6	18	13.3	2	19	53.8	27	7	16.3	26	16	27.9
7	Fri	27	5	57.1	12	05.3	18	13.7	3	22	12.9	1	10	09.2	27	17	14.9
8	Sat	28	5	56.1	12	05.0	18	14.1	4	24	18.2	2	12	52.0	1	17	52.7
9	Sun	29	5	55.2	12	04.7	18	14.4	S 5	26	01.8	3	15	17.5	2	18	15.3
10	Mon	30	5	54.2	12	04.4	18	14.8	6	27	15.1	4	17	17.7	3	18	18.0
11	Tue	31	5	53.2	12	04.1	18	15.2	7	27	50.2	5	18	43.9	4	17	53.1
12	Wed	Apr. 1	5	52.3	12	03.8	18	15.5	8	27	40.6	6	19	29.0	5	16	55.5
13	Thu	2	5	51.3	12	03.5	18	15.9	9	26	43.4	7	19	28.3	6	15	21.4
14	Fri	3	5	50.3	12	03.2	18	16.3	S 10	24	58.7	8	18	40.5	7	13	09.2
15	Sat	4	5	49.4	12	02.9	18	16.7	11	22	30.4	9	17	08.1	8	10	19.9
16	Sun	5	5	48.4	12	02.6	18	17.0	12	19	25.3	10	14	57.1	9	6	57.3
															(10	27	07.1)
17	Mon	6	5	47.5	12	02.4	18	17.4	13	15	52.3	11	12	16.0	11	22	56.7
18	Tue	7	5	46.6	12	02.1	18	17.8	14	12	01.8	12	9	15.4	12	18	35.1
19	Wed	8	5	45.6	12	01.8	18	18.2	S 15	8	05.1	13	6	06.9	13	14	11.6
									(K 1	28	13.7)	(14	27	02.7)			
20	Thu	9	5	44.7	12	01.5	18	18.5	2	24	39.2	15	24	14.9	14	9	55.5
21	Fri	10	5	43.8	12	01.3	18	18.9	3	21	32.2	16	21	54.7	15	5	56.0
															(16	26	21.7)
22	Sat	11	5	42.9	12	00.0	18	19.3	4	19	02.1	17	20	11.5	17	23	19.3
23	Sun	12	5	42.0	12	00.7	18	19.7	K 5	17	16.2	18	19	12.7	18	20	53.9
24	Mon	13	5	41.1	12	00.5	18	20.1	6	16	19.1	19	19	02.3	19	19	07.9
25	Tue	14	5	40.2	12	00.2	18	20.5	7	16	11.8	20	19	40.7	20	18	01.3
26	Wed	15	5	39.3	12	00.0	18	20.9	8	16	51.8	21	21	04.1	21	17	31.2
27	Thu	16	5	38.4	11	59.7	18	21.3	9	18	12.0	22	23	05.6	22	17	32.5
28	Fri	17	5	37.6	11	59.5	18	21.7	K 10	20	04.1	23	25	35.7	23	17	58.2
29	Sat	18	5	36.7	11	59.3	18	22.1	11	22	17.9	24	28	24.6	24	18	41.0
30	Sun	19	5	35.9	11	59.1	18	22.5	12	24	43.4	25	-	-	25	19	33.8
31	Mon	20	5	35.1	11	58.9	18	22.9	K 13	27	12.3	25	7	22.8	26	20	30.4

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1942

Month of CHAITRA (31 days)

Uttarayana
Uttara Gola

Ayanamsa on 1st : $24^0 08' 06''$

(*Nirayana*) 7 Chaitra, 5120 Kali Era to (*Nirayana*) 7 Vaisakha, 5121 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2020 A.D					
1	Mar. 21	SAURA CHAITRA	CHANDRA PHALGUNA			1- Indian New Year's Day, Maha Varuni (after $19^h 40^m.0$).
2	22					2- Madhukrishna Trayodasi, Varuni (upto $10^h 08^m.4$)
3	23				3 -SayanaVaidhriti ($23^h 17^m.1$)	
4	24				4- New Moon ($14^h 58^m.2$)	
5	25		CHANDRA CHAITRA			5- Chaitra Sukladi (Gudi Padava, Ugadi),Telugu New Year's Day, Vasanta Navaratrarambha, Cheti Chand (Sindhi New Year's Day).
6	26					
7	27					7- Gauri Tritiya (Gangaur), Sarhul (Bihar), Andolana Tritiya.
8	28					
9	29				9- Jupiter enters Makara ($27^h 54^m.2$)	9- Sri (Lakshmi) Panchami.
10	30					10- Skanda Shashthi.
11	31			11-Enters Revati nak. ($6^h 57^m.9$)		11- Vasanti Pujarambha, Oli begins(Jain).
12	Apr. 1					12- Asokashtami,Annapurna Puja, Mela Bahu Fort (Jammu).
13	2					13- Rama Navami.
14	3					
15	4					15- Kamada Ekadasi.
16	5				16-Sayana Vyatipata ($24^h 40^m.1$)	16- Birthday anniversary of Swami Leela Shah (Sindhi).
17	6					17- Ananga Trayodasi, Mahavira Jayanti (Jain), Damanaka Chaturdasi.
18	7					18- Panguni Uttiram.
19	8				19-Full Moon ($8^h 05^m.1$)	19- Chaitri Purnima, Hanumat Jayanti (S. India), Oli ends(Jain), Trivandrum Arat (Kerala).
20	9					
21	10					
22	11					
23	12			23- Saura Vaisakhadi ($22^h 41^m.9$)		
24	13			24- Enters Asvini nak. ($20^h 23^m.0$)		24- Chaitra Samkranti, Chadaka Puja (Bengal), Cheiraoba (Manipur), Visu (Kerala), Vaisakhi (H.P, Punjab, Haryana,Delhi,Odisha), Mesha Samkranti (Odisha), Rangali Bihu (Assam).
25	14	SAURA VAISAKHA				25- Dr. B.R.Ambedkar Jayanti, Bahag Bihu (Assam), Shilhenba (Manipur),Vaisakhadi(Bengal), Mesadi (T.N.), Beginning of Nirayana 5121 KE.
26	15					
27	16					
28	17				28-SayanaVaidhriti ($27^h 20^m.2$)	
29	18					29- Varuthini Ekadasi, Sri Vallabhacharya Jayanti.
30	19			30- Enters Trop. Taurus ($20^h 15^m.5$)		
31	Apr. 20					

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Kumbha 1, $6^h 20^m.4$; Mina 3, $18^h 37^m.0$; Mesha 6, $7^h 16^m.3$; Vrisha 8, $19^h 30^m.3$; Mithuna 11, $6^h 05^m.5$; Karkata 13, $13^h 32^m.9$; Simha 15, $17^h 08^m.1$; Kanya 17, $17^h 32^m.2$; Tula 19, $16^h 33^m.6$; Vrischika 21, $16^h 26^m.6$; Dhanus 23, $19^h 12^m.7$; Makara 25, $25^h 57^m.6$; Kumbha 28, $12^h 17^m.7$; Mina 30, $24^h 37^m.8$; Sun enters :- Nirayana Mesha 24, $20^h 23^m.0$.

INDIAN CALENDAR

SAKA ERA 1942 — Vrisha : Sukra

Month of VAISAKHA (31 days) — Summer (Grishma), 1st Month

(*Nirayana*) 8 Vaisakha, 5121 Kali Era to (*Nirayana)* 7 Jyaishtha, 5121 Kali Era

Date	Week Day	Gregorian Date	Sunrise h	Sunrise m	Apparent Noon h	Apparent Noon m	Sunset h	Sunset m	Tithi No.	Tithi Ending Moment h	Tithi Ending Moment m	Nakshatra No.	Nakshatra Ending Moment h	Nakshatra Ending Moment m	Yoga No.	Yoga Ending Moment h	Yoga Ending Moment m
		2020 A.D.															
1	Tue	Apr. 21	5	34.2	11	58.7	18	23.3	K 14	-	-	26	10	22.5	27	21	25.9
2	Wed	22	5	33.4	11	58.5	18	23.7	14	5	38.1	27	13	18.0	1	22	16.4
3	Thu	23	5	32.6	11	58.3	18	24.2	K 30	7	55.8	1	16	04.7	2	22	59.2
4	Fri	24	5	31.9	11	58.1	18	24.6	S 1	10	01.8	2	18	39.2	3	23	31.5
5	Sat	25	5	31.1	11	57.9	18	25.0	2	11	52.2	3	20	57.6	4	23	50.7
6	Sun	26	5	30.3	11	57.8	18	25.4	3	13	23.3	4	22	55.9	5	23	53.5
7	Mon	27	5	29.6	11	57.6	18	25.9	4	14	30.3	5	24	29.3	6	23	36.4
8	Tue	28	5	28.9	11	57.5	18	26.3	S 5	15	08.3	6	25	32.7	7	22	55.4
9	Wed	29	5	28.2	11	57.3	18	26.8	6	15	12.6	7	26	01.5	8	21	47.0
10	Thu	30	5	27.5	11	57.2	18	27.2	7	14	39.5	8	25	52.6	9	20	08.5
11	Fri	May 1	5	26.8	11	57.1	18	27.6	8	13	27.2	9	25	04.8	10	17	58.4
12	Sat	2	5	26.1	11	57.0	18	28.1	9	11	36.2	10	23	40.0	11	15	17.5
13	Sun	3	5	25.4	11	56.9	18	28.5	S 10	9	09.7	11	21	42.6	12	12	08.3
14	Mon	4	5	24.8	11	56.8	18	29.0	11	6	13.2	12	19	19.3	13	8	35.1
									(12	26	54.2)				(14	28	44.1)
15	Tue	5	5	24.2	11	56.7	18	29.5	13	23	21.6	13	16	38.9	15	24	42.3
16	Wed	6	5	23.6	11	56.6	18	29.9	14	19	45.2	14	13	51.4	16	20	38.1
17	Thu	7	5	23.0	11	56.5	18	30.4	S 15	16	15.3	15	11	07.4	17	16	39.7
18	Fri	8	5	22.4	11	56.5	18	30.8	K 1	13	02.2	16	8	37.8	18	12	55.6
19	Sat	9	5	21.8	11	56.4	18	31.3	2	10	15.6	17	6	33.1	19	9	33.5
												(18	29	02.4)			
20	Sun	10	5	21.3	11	56.4	18	31.8	3	8	04.4	19	28	13.1	20	6	40.4
															(21	28	21.7)
21	Mon	11	5	20.8	11	56.4	18	32.2	4	6	35.6	20	28	09.9	22	26	40.6
22	Tue	12	5	20.2	11	56.4	18	32.7	K 5	5	53.6	21	28	54.0	23	25	37.7
23	Wed	13	5	19.8	11	56.3	18	33.2	6	5	59.8	22	-	-	24	25	11.3
24	Thu	14	5	19.3	11	56.3	18	33.7	7	6	51.6	22	6	22.7	25	25	16.8
25	Fri	15	5	18.8	11	56.4	18	34.1	8	8	22.6	23	8	29.7	26	25	47.5
26	Sat	16	5	18.4	11	56.4	18	34.6	9	10	23.4	24	11	05.3	27	26	35.3
27	Sun	17	5	18.0	11	56.4	18	35.1	K 10	12	42.7	25	13	58.5	1	27	31.7
28	Mon	18	5	17.6	11	56.4	18	35.6	11	15	09.0	26	16	57.8	2	28	28.9
29	Tue	19	5	17.2	11	56.5	18	36.0	12	17	31.8	27	19	53.4	3	-	-
30	Wed	20	5	16.9	11	56.6	18	36.5	13	19	43.0	1	22	37.1	3	5	20.1
31	Thu	May 21	5	16.5	11	56.6	18	37.0	K 14	21	36.6	2	25	03.6	4	6	00.3

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1942

Month of VAISAKHA (31 days)

Uttarayana
Uttara Gola

Ayanamsa on 1st : $24^{0}\,08^{/}\,08^{//}$

(*Nirayana*) 8 Vaisakha, 5121 Kali Era to (*Nirayana)* 7 Jyaishtha, 5121 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2020 A.D					
1	Apr. 21	SAURA VAISAKHA	CHANDRA CHAITRA			
2	22					
3	23		CHAANDRA VAISAKHA		3- New Moon ($7^{h}\,55^{m}.8$)	3- Babu Kuer Singh Day (Bihar), Tithi of Sri Deva Damodara (Assam)
4	24					
5	25					5- Parasuram Jayanti
6	26					6- Akshaya Tritiya, Varshitapa Samapanna (Jain), Kedar Badri Yatra.
7	27			7- Enters Bharani nak. ($12^{h}\,8^{m}.4$)		
8	28					8- Sri Shankaracharya Jayanti, Sri Ramanujacharya Jayanti (S.India)
9	29					9- Sri Ramanujacharya Jayanti.
10	30					10- Gangotpatti.
11	May 1				11- Sayana Vyatipata ($15^{h}\,17^{m}.8$)	11- May Day
12	2					12- Sita Navami, Trichur Pooram (Kerala).
13	3					13- Mohini Ekadasi(Smarta), Birthday Anniversary of Dada Chellaram (Sindhi).
14	4					14- Mohini Ekadasi(Vaishnava & Vidhava), Minakshi Kalyanam, Trisprisa Mahadvadasi
15	5					
16	6					16- Nrisimha Chaturdasi.
17	7				17-Full Moon ($16^{h}\,15^{m}.3$)	17- Vaisakhi Purnima, Buddha Purnima.
18	8					18- Birthday of Rabindranath Tagore
19	9					
20	10					
21	11			21- Enters Krittika nak. ($6^{h}\,22^{m}.7$)		
22	12					
23	13			23- Saura Jyaishthadi ($19^{h}\,12^{m}.8$)	23-Sayana Vaidhriti ($10^{h}\,33^{m}.0$)	
24	14					
25	15	SAURA JYAISHTHA				
26	16					
27	17					
28	18					28- Apara Ekadasi, Bhadrakali Ekadasi(Punjab)
29	19					
30	20			30- Enters Trop. Gemini ($19^{h}\,19^{m}.2$)		
31	21					31- Savitri Chaturdasi, Phalaharini Kalika puja

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Mesha 2, $13^{h}\,18^{m}.0$; Visha 4, $25^{h}\,15^{m}.4$; Mithuna 7, $11^{h}\,46^{m}.1$; Karkata 9, $19^{h}\,57^{m}.8$; Simha 11, $25^{h}\,04^{m}.8$; Kanya 13, $27^{h}\,08^{m}.9$; Tula 15, $27^{h}\,15^{m}.4$; Vrishchika 17, $27^{h}\,13^{m}.3$; Dhanush 19, $29^{h}\,02^{m}.4$; Makara 22, $10^{h}\,16^{m}.5$; Kumbha 24, $19^{h}\,22^{m}.0$; Mina 27, $7^{h}\,14^{m}.2$; Mesha 29, $19^{h}\,53^{m}.4$; Sun enters :- Nirayana Vrisha 24, $17^{h}\,16^{m}.2$.

INDIAN CALENDAR
SAKA ERA 1942
Month of JYAISHTHA (31 days)

Mithuna : Suchi
Summer (Grishma), 2nd Month

(*Nirayana*) 8 Jyaishtha, 5121 Kali Era to (*Nirayana*) 7 Ashadha, 5121 Kali Era

Date	Week Day	Gregorian Date		Sunrise		Apparent Noon		Sunset		Tithi				Nakshatra			Yoga		
										No.		Ending Moment		No.	Ending Moment		No.	Ending Moment	
				h	m	h	m	h	m			h	m		h	m		h	m
		2020 A.D.																	
1	Fri	May	22	5	16.2	11	56.7	18	37.4	K	30	23	08.8	3	27	09.2	5	6	25.8
2	Sat		23	5	15.9	11	56.8	18	37.9	S	1	24	17.5	4	28	51.7	6	6	34.3
3	Sun		24	5	15.6	11	56.9	18	38.4		2	25	01.1	5	-	-	7	6	24.2
4	Mon		25	5	15.4	11	57.0	18	38.8		3	25	18.6	5	6	09.6	8	5	54.5
																	(9	29	04.2)
5	Tue		26	5	15.1	11	57.1	18	39.3		4	25	09.3	6	7	02.1	10	27	52.7
6	Wed		27	5	14.9	11	57.2	18	39.7	S	5	24	32.4	7	7	28.0	11	26	19.2
7	Thu		28	5	14.7	11	57.3	18	40.2		6	23	27.7	8	7	26.8	12	24	23.5
8	Fri		29	5	14.5	11	57.5	18	40.6		7	21	55.7	9	6	58.1	13	22	05.7
9	Sat		30	5	14.3	11	57.6	18	41.1		8	19	57.9	10	6	02.8	14	19	27.0
														(11	28	42.6)			
10	Sun		31	5	14.2	11	57.7	18	41.5		9	17	37.2	12	27	01.1	15	16	29.5
11	Mon	June	1	5	14.1	11	57.9	18	41.9	S	10	14	57.7	13	25	02.9	16	13	16.3
12	Tue		2	5	13.9	11	58.1	18	42.4		11	12	05.0	14	22	54.5	17	9	51.7
13	Wed		3	5	13.9	11	58.2	18	42.8		12	9	05.5	15	20	43.0	18	6	20.9
																	(19	26	49.8)
14	Thu		4	5	13.8	11	58.4	18	43.2		13	6	06.5	16	18	36.5	20	23	24.9
											(14	27	16.1)						
15	Fri		5	5	13.7	11	58.6	18	43.6	S	15	24	42.4	17	16	43.5	21	20	12.6
16	Sat		6	5	13.7	11	58.7	18	44.0	K	1	22	33.4	18	15	12.3	22	17	19.3
17	Sun		7	5	13.7	11	58.9	18	44.4		2	20	56.2	19	14	10.7	23	14	50.8
18	Mon		8	5	13.7	11	59.1	18	44.7		3	19	56.8	20	13	45.1	24	12	52.0
19	Tue		9	5	13.7	11	59.3	18	45.1		4	19	39.4	21	14	00.2	25	11	26.2
20	Wed		10	5	13.7	11	59.5	18	45.4	K	5	20	05.0	22	14	57.5	26	10	34.5
21	Thu		11	5	13.8	11	59.7	18	45.8		6	21	11.5	23	16	35.4	27	10	16.1
22	Fri		12	5	13.9	11	59.9	18	46.1		7	22	52.8	24	18	48.5	1	10	27.2
23	Sat		13	5	14.0	12	00.1	18	46.4		8	24	59.5	25	21	27.7	2	11	01.7
24	Sun		14	5	14.1	12	00.3	18	46.7		9	27	19.8	26	24	21.5	3	11	51.6
25	Mon		15	5	14.2	12	00.5	18	47.0	K	10	-	-	27	27	17.5	4	12	47.8
26	Tue		16	5	14.3	12	00.8	18	47.3		10	5	40.8	1	-	-	5	13	41.2
27	Wed		17	5	14.5	12	01.0	18	47.6		11	7	50.7	1	6	03.8	6	14	23.6
28	Thu		18	5	14.7	12	01.2	18	47.8		12	9	39.9	2	8	30.6	7	14	48.7
29	Fri		19	5	14.8	12	01.4	18	48.1		13	11	01.6	3	10	31.2	8	14	51.8
30	Sat		20	5	15.0	12	01.6	18	48.3		14	11	52.4	4	12	01.8	9	14	30.6
31	Sun	June	21	5	15.3	12	01.9	18	48.5	K	30	12	11.4	5	13	01.4	10	13	44.4

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1942

Uttarayana
Uttara Gola

Month of JYAISHTHA (31 days)

Ayanamsa on 1st : $24^0 08' 12''$

(*Nirayana*) 8 Jyaishtha, 5121 Kali Era to (*Nirayana*) 7 Ashadha, 5121 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2020A.D.					
1	May 22	SAURA JYAISHTHA	Chandra Vaisakha		1- New Moon ($23^h 08^m.8$)	1- Vata Savitri Vrata(Amavasya Paksha).
2	23		CHANDRA JYAISHTHA			
3	24			3- Enters Rohini nak.(26^h $33^m.4$)		
4	25					4- Rambha Tritiya, Pratap Jayanti (Rajasthan).
5	26				5- Sayana Vyatipata ($25^h 7^m.0$)	5- Guru Arjan Dev's Martyrdom Day (Sikh).
6	27					
7	28					7- Vindhyavasini Puja, Aranya Shashthi, Jamatri Shashthi (Bengal).
8	29					
9	30					9- Mela Kshir Bhawani (Kashmir)
10	31				10- Venus sets in the East ($05^h 42^m$)	
11	June 1					11- Ganga Dasahara (hasta upto 25^h 03^m)
12	2					12- Nirjala Ekadasi.
13	3					13- Champaka Dvadasi.
14	4					
15	5				15- Full Moon ($24^h 42^m.4$)	15- Vata Savitri Vrata (Purnima Paksha), Deva Snana Purnima.
16	6					16- Guru Hargobind's Birthday(J&K)
17	7			17- Enters Mrigasiras nak.(24^h $28^m.3$)	17- Sayana Vaidhriti (23^h $11^m.8$)	
18	8				18- Venus rises in the West (19^h 22^m)	
19	9					
20	10					
21	11					
22	12					
23	13			23- Saura Ashadhadi ($25^h 35^m.3$)		
24	14					24- Rajas Samkranti (Odisha).
25	15	SAURA ASHADHA				
26	16					
27	17					27- Jogini Ekadasi.
28	18					
29	19					
30	20			30- Enters Trop. Cancer ($27^h 13^m.6$)		
31	June 21			31- Enters Ardra nak.($23^h 28^m.0$)	31- Sayana Vyatipata ($10^h 55^m.1$) 31- Annular Solar Eclipse (visible in India) 31- New Moon ($12^h 11^m.4$)	31- Dakshinayana Day, Chudamani Yoga

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Vrisha 1, 7^h $37^m.1$; Mithuna 3, $17^h 33^m.8$; Karkata 5, 25^h $24^m.1$; Simha 8, 6^h $58^m.1$; Kanya 10, 10^h $19^m.0$; Tula 12, 11^h $59^m.6$; Vrischika 14, 13^h $07^m.2$; Dhanus 16, 15^h $12^m.3$, Makara 18, 19^h $45^m.0$; Kumbha 20, 27^h $41^m.6$; Mina 23, 14^h $46^m.0$; Mesha 25, 27^h $17^m.5$; Vrisha 28, 15^h $03^m.4$; Mithuna 30, 24^h $35^m.4$; Sun enters :-Nirayana Mithuna 24, 23^h $53^m.9$.

INDIAN CALENDAR

SAKA ERA 1942

Month of ASHADHA (31 days)

Karkata :Nabhas
Rains (Varsa), 1st Month

(*Nirayana*) 8 Ashadha, 5121 Kali Era to (*Nirayana*) 7 Sravna, 5121 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi No.	Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2020 A.D.															
1	Mon	June 22	5	15.5	12	02.1	18	48.7	S 1	11	59.7	6	13	30.9	11	12	34.0
2	Tue	23	5	15.7	12	02.3	18	48.9	2	11	19.7	7	13	32.8	12	11	01.1
3	Wed	24	5	16.0	12	02.5	18	49.1	3	10	14.6	8	13	10.2	13	9	08.0
4	Thu	25	5	16.3	12	02.7	18	49.2	4	8	48.0	9	12	26.6	14	6	57.3
															(15	28	31.8)
5	Fri	26	5	16.5	12	02.9	18	49.4	S 5	7	03.4	10	11	25.8	16	25	54.1
									(6	29	04.2)						
6	Sat	27	5	16.8	12	03.1	18	49.5	7	26	54.0	11	10	11.1	17	23	06.8
7	Sun	28	5	17.1	12	03.3	18	49.6	8	24	35.9	12	8	46.1	18	20	12.7
8	Mon	29	5	17.4	12	03.5	18	49.7	9	22	13.3	13	7	14.1	19	17	14.3
9	Tue	30	5	17.8	12	03.7	18	49.7	S 10	19	50.0	14	5	38.8	20	14	14.6
												(15	28	04.0)			
10	Wed	July 1	5	18.1	12	03.9	18	49.8	11	17	29.9	16	26	34.1	21	11	16.6
11	Thu	2	5	18.4	12	04.1	18	49.8	12	15	17.3	17	25	13.7	22	8	23.9
12	Fri	3	5	18.8	12	04.3	18	49.8	13	13	17.0	18	24	07.9	23	5	40.0
															(24	27	09.0)
13	Sat	4	5	19.2	12	04.5	18	49.8	14	11	34.3	19	23	22.2	25	24	55.0
14	Sun	5	5	19.5	12	04.7	18	49.7	S 15	10	14.4	20	23	02.0	26	23	02.1
15	Mon	6	5	19.9	12	04.8	18	49.7	K 1	9	22.5	21	23	12.0	27	21	33.8
16	Tue	7	5	20.3	12	05.0	18	49.6	388 2	9	03.1	22	23	55.9	1	20	32.8
17	Wed	8	5	20.7	12	05.1	18	49.5	3	9	19.2	23	25	15.4	2	20	00.5
18	Thu	9	5	21.1	12	05.3	18	49.4	4	10	11.7	24	27	09.3	3	19	56.2
19	Fri	10	5	21.5	12	05.4	18	49.3	K 5	11	38.5	25	-	-	4	20	17.1
20	Sat	11	5	21.9	12	05.6	18	49.1	6	13	33.8	25	5	33.0	5	20	57.9
21	Sun	12	5	22.3	12	05.7	18	49.0	7	15	48.3	26	8	18.3	6	21	50.8
22	Mon	13	5	22.7	12	05.8	18	48.8	8	18	09.8	27	11	13.9	7	22	46.7
23	Tue	14	5	23.1	12	05.9	18	48.6	9	20	24.7	1	14	06.6	8	23	35.8
24	Wed	15	5	23.5	12	06.0	18	48.3	K 10	22	20.1	2	16	43.3	9	24	08.7
25	Thu	16	5	24.0	12	06.1	18	48.1	11	23	45.4	3	18	52.9	10	24	17.9
26	Fri	17	5	24.4	12	06.2	18	47.8	12	24	33.6	4	20	27.6	11	23	58.1
27	Sat	18	5	24.8	12	06.3	18	47.5	13	24	41.8	5	21	23.4	12	23	06.7
28	Sun	19	5	25.3	12	06.3	18	47.2	14	24	10.4	6	21	40.1	13	21	43.8
29	Mon	20	5	25.7	12	06.4	18	46.9	K 30	23	02.9	7	21	20.6	14	19	51.5
30	Tue	21	5	26.1	12	06.4	18	46.5	S 1	21	24.8	8	20	30.2	15	17	33.6
31	Wed	22	5	26.6	12	06.5	18	46.2	S 2	19	22.6	9	19	15.6	16	14	55.1

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

Dakshinayana — SAKA ERA 1942

Uttara Gola — Month of ASHADHA (31 days) — Ayanamsa on 1st : $24^{0} 08^{/} 18^{//}$

(*Nirayana*) 8 Ashadha, 5121 Kali Era to (*Nirayana*) 7 Sravana, 5121 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2020A.D.					
1	June 22	SAURA ASHADHA	CHANDRA ASHADHA			1- Manoratha Dvitiya Vrata (Bengal).
2	23					2- Rathayatra.
3	24					
4	25					
5	26					5- Kumara Shashthi (Vrata).
6	27					6- Vivasvat Saptami.
7	28					7- Kharchi Puja (Tripura).
8	29					8- Mela Sharik Bhagwati (Kashmir).
9	30				9- Jupiter enters into Dhanus ($5^h 22^m.2$)	9- Punaryatra(Smarta).
10	July 1					10- Harisayani Ekadasi, Ultarath (Odisha), Bahudha Yatra.
11	2					
12	3				12- Sayana Vaidhriti ($13^h 49^m.0$)	
13	4					13- Mela Jwalamukhi (Kashmir).
14	5			14- Enters Punarvasu nak.($23^h 03^m.6$)	14- Full Moon ($10^h 14^m.4$)	14- Guru Purnima, Vyasa Puja, Ashadhi Purnima.
15	6					
16	7					
17	8					
18	9					
19	10					19- Naga Panchami (Bengal).
20	11					
21	12					
22	13					22- Martyr's day (Kashmir).
23	14					23- Ker puja(Tripura).
24	15			24- Saura Sravanadi ($12^h 24^m.7$)		
25	16				25- Sayana Vyatipata ($21^h 20^m.9$)	25- Kamika Ekadasi, Manasa Puja begins
26	17	SAURA SRAVANA				
27	18					
28	19			29- Enters Pushya nak. ($22^h 36^m.3$)		
29	20				29- New Moon ($23^h 02^m.9$)	29- Chitalagi Amavasya(Odisha), Adi Amavasya(Tamil Nadu), Karkataka Vavu(Kerala).
30	21					
31	July 22		CHANDRA SRAVANA	31- Enters Trop. Leo ($14^h 06^m.8$)		

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters:- Karkata 2, $7^h 34^m.7$; Simha 4, $12^h 26^m.6$; Kanya 6, $15^h 50^m.7$; Tula 8, $18^h 26^m.6$; Vrischika 10, $20^h 55^m.9$; Dhanus 12, $24^h 07^m.9$; Makara 14, $29^h 01^m.4$; Kumbha 17, $12^h 31^m.2$; Mina 19, $22^h 54^m.7$; Mesha 22, $11^h 13^m.9$; Vrisha 24, $23^h 18^m.7$; Mithuna 27, $9^h 00^m.5$; Karkata 29, $15^h 28^m.6$; Simha 31, $19^h 15^m.6$; Sun enters:-Nirayana Karkata 25, $10^h 47^m.1$;

INDIAN CALENDAR

SAKA ERA 1942

Simha : Nabhasya
Rains (Varsa), 2nd Month

Month of SRAVANA (31 days)

(*Nirayana*) 8 Sravana, 5121 Kali Era to (*Nirayana*) 7 Bhadra, 5121 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi No.	Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2019 A.D.															
1	Thu	Jul. 23	5	27.0	12	06.5	18	45.8	S 3	17	03.6	10	17	44.0	17	12	01.5
2	Fri	24	5	27.5	12	06.5	18	45.4	4	14	34.7	11	16	02.7	18	8	58.3
3	Sat	25	5	27.9	12	06.5	18	44.9	S 5	12	02.5	12	14	18.5	19	5	51.1
															(20	26	44.6)
4	Sun	26	5	28.3	12	06.5	18	44.5	6	9	32.7	13	12	37.2	21	23	42.8
5	Mon	27	5	28.8	12	06.5	18	44.0	7	7	10.0	14	11	03.7	22	20	49.0
									(8	28	58.2)						
6	Tue	28	5	29.2	12	06.5	18	43.5	9	26	59.7	15	9	41.5	23	18	05.5
7	Wed	29	5	29.6	12	06.5	18	43.0	S 10	25	16.6	16	8	33.1	24	15	33.9
8	Thu	30	5	30.1	12	06.4	18	42.5	11	23	50.4	17	7	40.5	25	13	15.6
9	Fri	31	5	30.5	12	06.4	18	42.0	12	22	42.5	18	7	05.1	26	11	11.6
10	Sat	Aug. 1	5	30.9	12	06.3	18	41.4	13	21	54.8	19	6	48.4	27	9	23.1
11	Sun	2	5	31.3	12	06.3	18	40.8	14	21	29.4	20	6	52.2	1	7	51.5
12	Mon	3	5	31.8	12	06.2	18	40.3	S 15	21	28.8	21	7	18.9	2	6	38.4
13	Tue	4	5	32.2	12	06.1	18	39.6	K 1	21	55.4	22	8	10.9	3	5	45.8
															(4	29	15.0)
14	Wed	5	5	32.6	12	06.0	18	39.0	2	22	50.8	23	9	30.4	5	29	06.9
15	Thu	6	5	33.0	12	05.9	18	38.4	3	24	15.4	24	11	18.2	6	29	21.1
16	Fri	7	5	33.4	12	05.7	18	37.7	4	26	06.7	25	13	33.4	7	-	-
17	Sat	8	5	33.8	12	05.6	18	37.0	K 5	28	19.1	26	16	11.9	7	5	55.2
18	Sun	9	5	34.2	12	05.5	18	36.3	6	-	-	27	19	06.2	8	6	44.5
19	Mon	10	5	34.6	12	05.3	18	35.6	6	6	43.4	1	22	05.6	9	7	41.9
20	Tue	11	5	35.0	12	05.2	18	34.9	7	9	07.3	2	24	56.8	10	8	38.6
21	Wed	12	5	35.4	12	05.0	18	34.2	8	11	16.9	3	27	26.4	11	9	24.6
22	Thu	13	5	35.8	12	04.8	18	33.4	9	12	58.9	4	29	22.2	12	9	50.0
23	Fri	14	5	36.2	12	04.6	18	32.7	K 10	14	02.4	5	-	-	13	9	46.4
24	Sat	15	5	36.6	12	04.4	18	31.9	11	14	20.5	5	6	35.8	14	9	08.0
25	Sun	16	5	37.0	12	04.2	18	31.1	12	13	50.9	6	7	02.9	15	7	52.0
26	Mon	17	5	37.3	12	04.0	18	30.3	13	12	35.7	7	6	44.0	16	5	58.7
															(17	27	31.0)
27	Tue	18	5	37.7	12	03.8	18	29.5	14	10	40.0	8	5	43.4	18	24	34.2
												(9	28	08.1)			
28	Wed	19	5	38.1	12	03.6	18	28.6	K 30	8	11.6	10	26	07.2	19	21	15.1
									(S 1	29	19.6)						
29	Thu	20	5	38.4	12	03.3	18	27.8	2	26	13.5	11	23	50.8	20	17	41.3
30	Fri	21	5	38.8	12	03.1	18	26.9	3	23	03.2	12	21	28.9	21	14	00.6
31	Sat	22	5	39.1	12	02.8	18	26.1	S 4	19	57.7	13	19	11.2	22	10	20.6

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1942

Month of SRAVANA (31 days)

Dakshinayana
Uttara Gola

Ayanamsa on 1st : $24^0 08' 23''$

(Nirayana) 8 Sravana, 5121 Kali Era to *(Nirayana)* 7 Bhadra, 5121 Kali Era

Date	Gergorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2020A.D.					
1	July 23	SAURA SRAVANA	CHANDRA SRAVANA			1- Madhusrava Tritiya (Teej), Adi Puram (S. India).
2	24					
3	25					3- Naga Panchami.
4	26					
5	27					5- Goswami Tulasi Das Jayanti.
6	28				6- Sayana Vaidhriti ($26^h 13^m.1$)	
7	29					
8	30					8- Pavitra Ekadasi, Jhulana Yatrarambha.
9	31					9- Vara Mahalakshmi Vrata (S. India).
10	Aug. 1					10- Tilak Commemoration Day.
11	2			11- Enters Aslesha nak. ($21^h 28^m.7$)		
12	3				12- Full Moon ($21^h 28^m.8$)	12- Raksha Bandhana, Jhulana Yatra Samapanna, Naroli Purnima, Balabhadra Puja(Odisha), Amarnath yatra, Solono (Rakhi Bandhan-Delhi), Avani Avittam (S. India), Jaju Upakarma, Sravani Purnima.
13	4					13- Gayatri Japam, Rik Upakarma.
14	5					
15	6					15- Teejri (Sindhi).
16	7					16- Bahula Chaturthi (Sankashtha Chaturthi).
17	8					17- Raksha Panchami (Odisha).
18	9					
19	10					
20	11				20- Sayana Vyatipata ($5^h 37^m.7$)	20- Janmashtmi(Smarta), Vadi Thadri (Sindhi).
21	12					21- Janmashtmi(Vaishnava), Gokulashtami(Nandotsava).
22	13					
23	14					
24	15			24- Saura Bhadrapadadi ($20^h 57^m.2$)		24- Independence Day, Paryushana Parvarambha(Chaturthi Paksha) (Jain), Aja Ekadasi.
25	16	SAURA BHADRAPADA		25- Enters Magha nak. ($19^h 11^m.4$)		25- Paryusana Parvarambha(Panchami Paksha) (Jain), Manasa Puja ends(Bengal).
26	17					26- Simhadi(Kerala), Aghora Chaturdasi., Kailash yatra - 2 days
27	18					27- Saptapuri Amavasya(Odisha), Pithori.
28	19		CHANDRA BHADRAPADA		28- New Moon ($8^h 11^m.6$)	28- Kusotpatini, Jain Festival.
29	20					29- Tithi of Sri Sankara Deva (Assam).
30	21					30- Haritalika Gauri Tritya.
31	Aug. 22			31- EntersTrop. Virgo ($21^h 14^m.9$)		31- Samaveda Upakarma, Haritalika Chaturthi, Vinayak Chaturthi(T.N.),Ganesha Chaturthi,Samvatsari(Chaturthi Paksha - Jain)

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Kanya 2, $21^h 36^m.7$; Tula 4, $23^h 49^m.3$; Vrischika 6, $26^h 48^m.1$; Dhanus 9, $07^h 05^m.1$; Makara 11, $12^h 56^m.7$; Kumbha 13, $20^h 47^m.2$; Mina 16, $6^h 57^m.1$; Mesha 18, $19^h 06^m.2$; Vrisha 21, $7^h 36^m.8$; Mithuna 23, $18^h 05^m.0$; Karkata 25, $24^h 52^m.9$; Simha 27, $28^h 08^m.1$; Kanya 29, $29^h 15^m.4$:;

Sun enters :- Nirayana Simha 25, $19^h 11^m.4$.

INDIAN CALENDAR

SAKA ERA 1942

Kanya: Isha

Month of BHADRA (31 days)

Autumn (Sarat), 1st Month

(*Nirayana*) 8 Bhadra, 5121 Kali Era to (*Nirayana)* 7 Asvina, 5121 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi			Nakshatra			Yoga		
									No.	Ending Moment		No.	Ending Moment		No.	Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2019 A.D.															
1	Sun	Aug. 23	5	39.5	12	02.6	18	25.2	S 5	17	05.0	14	17	06.1	23	6	48.3
															24	27	29.6
2	Mon	24	5	39.8	12	02.3	18	24.3	6	14	31.6	15	15	20.3	25	24	29.0
3	Tue	25	5	40.2	12	02.0	18	23.4	7	12	22.3	16	13	58.8	26	21	49.3
4	Wed	26	5	40.5	12	01.7	18	22.5	8	10	39.9	17	13	04.1	27	19	32.0
5	Thu	27	5	40.9	12	01.5	18	21.6	9	9	25.6	18	12	37.2	1	17	37.1
6	Fri	28	5	41.2	12	01.2	18	20.6	S 10	8	38.7	19	12	37.3	2	16	03.9
7	Sat	29	5	41.5	12	00.9	18	19.7	11	8	18.0	20	13	02.8	3	14	51.1
8	Sun	30	5	41.9	12	00.5	18	18.8	12	8	21.9	21	13	52.0	4	13	57.3
9	Mon	31	5	42.2	12	00.2	18	17.8	13	8	49.2	22	15	03.9	5	13	21.6
10	Tue	Sept. 1	5	42.5	11	59.9	18	16.8	14	9	39.3	23	16	37.9	6	13	03.6
11	Wed	2	5	42.8	11	59.6	18	15.9	S 15	10	52.1	24	18	33.7	7	13	03.0
12	Thu	3	5	43.1	11	59.3	18	14.9	K 1	12	27.4	25	20	50.9	8	13	19.6
13	Fri	4	5	43.4	11	58.9	18	13.9	2	14	24.1	26	23	28.0	9	13	52.4
14	Sat	5	5	43.8	11	58.6	18	12.9	3	16	39.3	27	26	21.1	10	14	39.2
15	Sun	6	5	44.1	11	58.3	18	12.0	4	19	07.3	1	29	23.7	11	15	36.0
16	Mon	7	5	44.4	11	57.9	18	11.0	K 5	21	39.2	2	-	-	12	16	36.7
17	Tue	8	5	44.7	11	57.6	18	10.0	6	24	03.2	2	8	25.8	13	17	33.2
18	Wed	9	5	45.0	11	57.2	18	09.0	7	26	06.2	3	11	15.3	14	18	16.1
19	Thu	10	5	45.3	11	56.9	18	07.9	8	27	35.3	4	13	39.0	15	18	35.8
20	Fri	11	5	45.6	11	56.5	18	06.9	9	28	20.1	5	15	25.1	16	18	23.9
21	Sat	12	5	45.9	11	56.2	18	05.9	K 10	28	14.5	6	16	24.7	17	17	34.1
22	Sun	13	5	46.2	11	55.8	18	04.9	11	27	16.8	7	16	33.6	18	16	03.3
23	Mon	14	5	46.5	11	55.5	18	03.9	12	25	30.0	8	15	52.2	19	13	51.5
24	Tue	15	5	46.8	11	55.1	18	02.9	13	23	00.4	9	14	25.2	20	11	02.0
25	Wed	16	5	47.1	11	54.8	18	01.9	14	19	57.0	10	12	20.5	21	7	40.4
															(22	27	54.0)
26	Thu	17	5	47.4	11	54.4	18	00.8	K 30	16	30.2	11	9	48.2	23	23	51.5
27	Fri	18	5	47.8	11	54.0	17	59.8	S 1	12	51.0	12	6	59.7	24	19	42.0
												(13	28	06.7)			
28	Sat	19	5	48.1	11	53.7	17	58.8	2	9	10.5	14	25	20.5	25	15	34.5
									(3	29	39.4)						
29	Sun	20	5	48.4	11	53.3	17	57.8	4	26	27.5	15	22	51.7	26	11	37.4
30	Mon	21	5	48.7	11	53.0	17	56.8	S 5	23	42.8	16	20	48.8	27	7	58.2
															(1	28	43.0)
31	Tue	22	5	49.0	11	52.6	17	55.7	S 6	21	31.5	17	19	18.6	2	25	56.0

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1942

Dakshinayana

Uttara Gola

Month of BHADRA (31 days)

Ayanamsa on 1st : $24^0 08^{/} 27^{//}$

(*Nirayana*) 8 Bhadra, 5121 Kali Era to (*Nirayana)* 7 Asvina, 5121 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2020 A.D.					
1	Aug. 23	SAURA BHADRAPADA	CHAANDRA BHADRAPADA		1- Sayana Vaidhriti ($14^h 39^m.2$)	1- Samvatsari (Panchami Paksha-Jain), Rishi Panchami, Mela Pat-3 days(J&K).
2	24					2- Surya Shashthi.
3	25					3- Mahalakshmi Vratarambha. Durvashtami.
4	26					4- Radhashtami, Durvashtami(Bengal).
5	27					
6	28					
7	29					7- Dol Gyaras (MP), Heikru Hidongba (Manipur), Parsvaparivartani Ekadasi, Sakrotthana, Vamana Jayanti.
8	30			8- Enters PurvaPhalguni nak. ($15^h 06^m.8$)		8- First Onam Day.
9	31					9- Onam or Thiru Onam Day (Kerala).
10	Sept. 1					10- Indra Purnima,Ananta Chaturdasi, Third Onam Day(Kerala).
11	2				11- Full Moon ($10^h 52^m.1$)	11- Fourth Onam Day, Sri Narayana Guru Deva's Birthday (Kerala), Pitri Paksha Tarpana begins.
12	3					12- Keil Muhurth (Coorg).
13	4					
14	5				14- Sayana Vyatipata ($11^h 39^m.2$)	
15	6					
16	7					16- Tithi of Sri Madhava Deva (Assam).
17	8					
18	9					
19	10					19- Mahalakshmi Vrata Samapanna, Sri Jayanti (Ramanuja), Sri Krishna Jayanti (T.N., Assam & Kerala).
20	11					20- Matri Navami.
21	12					
22	13			22- Enters U. Phalguni nak. ($9^h 03^m.0$)		22- Indira Ekadasi.
23	14					
24	15			24- Saura Asvinadi ($21^h 11^m.2$)		24- Magha Trayodasi (Magha after $14^h 25^m$).
25	16					25- Visvakarma Puja.
26	17	SAURA ASVINA			26- New Moon ($16^h 30^m.2$)	26- Mahalaya Amavasya, Sarvapitri Amavasya (Odisha), Tarpana Layba (Manipur).
27	18		CHAANDRA ASVINA MALA		27- Sayana Vaidhriti ($7^h 22^m.7$)	
28	19					
29	20					
30	21					30- Samadhi day of Narayana Guru (Kerala).
31	Sept. 22			31- Enters Trop. Libra ($19^h 01^m.7$)		

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters : Tula 1, 6^h $06^m.5$;Vrischika 3, 08^h $16^m.7$;Dhanus 5, 12^h $37^m.2$;Makara 7,19^h $12^m.9$;Kumbha 9, 27^h $48^m.2$;Mina 12, 14^h $14^m.6$; Mesha 14, 26^h $21^m.2$;Vrisha 17,15^h $09^m.9$;Mithuna 19, 26^h $37^m.4$;Karkata 22, 10^h $36^m.2$;Simha 24, 14^h $25^m.2$;Kanya 26, 15^h $07^m.2$; Tula 28, 14^h $42^m.1$; Vrischika 30, 15^h $16^m.6$; Sun enters :-Nirayana Kanya 25, 19^h $07^m.7$.

INDIAN CALENDAR

SAKA ERA 1942

Tula : Urja

Month of ASVINA (30 days) — Autumn (Sarat), 2nd Month

(*Nirayana*) 8 Asvina, 5121 Kali Era to (*Nirayana*) 7 Kartika, 5121 Kali Era

Date	Week Day	Gregorian Date		Sunrise		Apparent Noon		Sunset		Tithi				Nakshatra			Yoga		
										No.		Ending Moment		No.	Ending Moment		No.	Ending Moment	
				h	m	h	m	h	m			h	m		h	m		h	m
		2020 A.D.																	
1	Wed	Sep.	23	5	49.3	11	52.3	17	54.7	S	7	19	57.5	18	18	25.1	3	23	39.5
2	Thu		24	5	49.6	11	51.9	17	53.7		8	19	02.0	19	18	09.6	4	21	53.7
3	Fri		25	5	50.0	11	51.6	17	52.7		9	18	44.0	20	18	30.9	5	20	37.2
4	Sat		26	5	50.3	11	51.2	17	51.7	S	10	19	00.3	21	19	25.7	6	19	47.4
5	Sun		27	5	50.6	11	50.9	17	50.7		11	19	46.8	22	20	49.6	7	19	20.8
6	Mon		28	5	50.9	11	50.6	17	49.7		12	20	59.2	23	22	38.3	8	19	14.1
7	Tue		29	5	51.3	11	50.2	17	48.7		13	22	33.5	24	24	47.8	9	19	24.2
8	Wed		30	5	51.6	11	49.9	17	47.7		14	24	26.4	25	27	14.9	10	19	48.7
9	Thu	Oct.	1	5	51.9	11	49.6	17	46.7	S	15	26	35.3	26	-	-	11	20	25.4
10	Fri		2	5	52.3	11	49.3	17	45.7	K	1	28	57.1	26	5	56.8	12	21	12.4
11	Sat		3	5	52.6	11	48.9	17	44.8		2	-	-	27	8	50.6	13	22	07.0
12	Sun		4	5	53.0	11	48.6	17	43.8		2	7	28.1	1	11	52.4	14	23	05.9
13	Mon		5	5	53.4	11	48.3	17	42.8		3	10	02.6	2	14	56.2	15	24	03.8
14	Tue		6	5	53.7	11	48.0	17	41.9		4	12	32.5	3	17	54.0	16	24	54.4
15	Wed		7	5	54.1	11	47.7	17	40.9	K	5	14	47.8	4	20	35.7	17	25	30.0
16	Thu		8	5	54.5	11	47.5	17	40.0		6	16	37.1	5	22	50.0	18	25	42.2
17	Fri		9	5	54.8	11	47.2	17	39.1		7	17	49.8	6	24	26.7	19	25	23.7
18	Sat		10	5	55.2	11	46.9	17	38.2		8	18	17.0	7	25	17.7	20	24	28.3
19	Sun		11	5	55.6	11	46.7	17	37.2		9	17	53.8	8	25	18.6	21	22	52.7
20	Mon		12	5	56.0	11	46.4	17	36.3	K	10	16	39.1	9	24	29.5	22	20	36.3
21	Tue		13	5	56.4	11	46.2	17	35.5		11	14	36.1	10	22	54.4	23	17	41.7
22	Wed		14	5	56.9	11	45.9	17	34.6		12	11	51.3	11	20	40.7	24	14	13.7
23	Thu		15	5	57.3	11	45.7	17	33.7		13	8	33.5	12	17	58.1	25	10	19.4
											(14	28	53.0)						
24	Fri		16	5	57.7	11	45.5	17	32.9	K	30	25	01.0	13	14	57.8	26	6	07.0
																	27	25	45.4
25	Sat		17	5	58.1	11	45.3	17	32.0	S	1	21	09.0	14	11	51.6	1	21	24.1
26	Sun		18	5	58.6	11	45.1	17	31.2		2	17	28.0	15	8	51.3	2	17	12.1
27	Mon		19	5	59.0	11	44.9	17	30.4		3	14	08.4	16	6	08.3	3	13	17.6
														(17	27	52.5)			
28	Tue		20	5	59.5	11	44.7	17	29.6		4	11	19.3	18	26	12.3	4	9	47.9
29	Wed		21	6	00.0	11	44.6	17	28.8	S	5	9	08.1	19	25	13.4	5	6	48.8
																	(6	28	24.0)
30	Thu		22	6	00.4	11	44.4	17	28.1	S	6	7	40.1	20	24	58.6	7	26	35.2

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1942

Dakshinayana | Dakshina Gola | Month of ASVINA (30 days) | Ayanamsa on 1st : $24^0 08^{/} 31^{//}$

(*Nirayana*) 8 Asvina, 5121 Kali Era to (*Nirayana*) 7 Kartika, 5121 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2020 A.D.					
1	Sept. 23	SAURA ASVINA	CHAANDRA ASVINA MALA			1- Jalavisuva Day.
2	24					
3	25					
4	26			4- Enters Hasta nak.($24^h 29^m.1$)		
5	27					5- Padmini Ekadasi (Purushottami).
6	28					
7	29					
8	30				8- Sayana Vyatipata ($16^h 51^m.8$)	
9	Oct. 1				9- Full Moon ($26^h 35^m.3$)	
10	2					10- Mahatma Gandhi's Birthday.
11	3					
12	4					
13	5					
14	6					
15	7					
16	8					
17	9					
18	10			18- Enters Chitra nak. ($13^h 34^m.5$)		
19	11					
20	12					
21	13				21- Sayana Vaidhriti ($25^h 28^m.8$)	21- Kamala Ekadasi (Purushottami).
22	14					
23	15					
24	16			24- Saura Kartikadi ($9^h 30^m.5$)	24- New Moon ($25^h 01^m.0$)	
25	17	SAURA KARTIKA	CHAANDRA ASVINA SUDDHA			25- Saradiya Navaratrarambha, Kaveri Samkramana Snana, Maharaja Agrasen Jayanti.
26	18					
27	19					
28	20					28- Upanga LalitaVrata (Lalita Panchami).
29	21					29- Saraswati Avahana.
30	Oct. 22			30- Enters Trop. Scorpio ($28^h 29^m.5$)		

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Dhanus 1, $18^h 25^m.1$; Makara 3, $24^h 41^m.6$; Kumbha 6, $9^h 41^m.2$; Mina 8, $20^h 36^m.6$; Mesha 11, $8^h 50^m.6$; Vrisha 13, $21^h 41^m.6$; Mithuna 16, $9^h 46^m.9$; Karkata 18, $19^h 09^m.5$; Simha 20, $24^h 29^m.5$; Kanya 22, $26^h 02^m.4$; Tula 24, $25^h 24^m.7$; Vrischika 26, $24^h 46^m.9$; Dhanus 28, $26^h 12^m.3$; Sun enters :- Nirayana Tula 25, $07^h 05^m.5$.

INDIAN CALENDAR

SAKA ERA 1942

Vrischika : Sahas
Hemanta, 1st Month

Month of KARTIKA (30 days)

(*Nirayana*) 8 Kartika, 5121 Kali Era to (*Nirayana*) 7 Agrahayana, 5121 Kali Era

Date	Week Day	Gregorian Date		Sunrise		Apparent Noon		Sunset		Tithi				Nakshatra			Yoga		
										No.		Ending Moment		No.	Ending Moment		No.	Ending Moment	
				h	m	h	m	h	m			h	m		h	m		h	m
		2020 A.D.																	
1	Fri	Oct.	23	6	00.9	11	44.3	17	27.3	S	7	6	57.4	21	25	27.8	8	25	21.5
2	Sat		24	6	01.4	11	44.2	17	26.6		8	6	59.3	22	26	37.8	9	24	40.5
3	Sun		25	6	01.9	11	44.0	17	25.8		9	7	42.3	23	28	23.0	10	24	27.9
4	Mon		26	6	02.4	11	43.9	17	25.1	S	10	9	00.5	24	-	-	11	24	38.4
5	Tue		27	6	02.9	11	43.8	17	24.4		11	10	47.0	24	6	36.5	12	25	06.8
6	Wed		28	6	03.4	11	43.8	17	23.8		12	12	54.4	25	9	11.0	13	25	47.9
7	Thu		29	6	04.0	11	43.7	17	23.1		13	15	16.1	26	11	59.8	14	26	37.3
8	Fri		30	6	04.5	11	43.6	17	22.5		14	17	46.1	27	14	57.1	15	27	31.0
9	Sat		31	6	05.1	11	43.6	17	21.8	S	15	20	19.2	1	17	57.8	16	28	25.6
10	Sun	Nov.	1	6	05.6	11	43.6	17	21.2	K	1	22	50.4	2	20	57.0	17	29	17.4
11	Mon		2	6	06.2	11	43.5	17	20.6		2	25	14.3	3	23	49.7	18	30	02.7
12	Tue		3	6	06.7	11	43.5	17	20.1		3	27	24.9	4	26	29.9	19	-	-
13	Wed		4	6	07.3	11	43.6	17	19.5		4	29	15.0	5	28	50.7	19	6	37.0
14	Thu		5	6	07.9	11	43.6	17	19.0	K	5	-	-	6	-	-	20	6	55.1
15	Fri		6	6	08.5	11	43.6	17	18.5	K	5	6	37.0	6	6	44.8	21	6	51.4
16	Sat		7	6	09.1	11	43.7	17	18.0		6	7	23.8	7	8	04.9	22	6	20.8
																	(23	29	18.7)
17	Sun		8	6	09.7	11	43.7	17	17.6		7	7	29.7	8	8	45.3	24	27	42.0
18	Mon		9	6	10.3	11	43.8	17	17.1		8	6	51.2	9	8	42.4	25	25	30.0
											(9	29	28.2)						
19	Tue		10	6	10.9	11	43.9	17	16.7	K	10	27	23.1	10	7	55.9	26	22	43.7
20	Wed		11	6	11.6	11	44.0	17	16.3		11	24	41.3	11	6	28.3	27	19	26.6
														(12	28	25.2)			
21	Thu		12	6	12.2	11	44.2	17	15.9		12	21	30.4	13	25	54.5	1	15	44.1
22	Fri		13	6	12.8	11	44.3	17	15.6		13	17	59.4	14	23	05.6	2	11	42.8
23	Sat		14	6	13.5	11	44.4	17	15.3		14	14	18.2	15	20	09.1	3	7	30.4
																	(4	27	15.2)
24	Sun		15	6	14.1	11	44.6	17	14.9	K	30	10	37.2	16	17	15.8	5	23	05.6
25	Mon		16	6	14.8	11	44.8	17	14.7	S	1	7	06.9	17	14	36.6	6	19	10.0
											(2	27	57.3)						
26	Tue		17	6	15.5	11	45.0	17	14.4		3	25	18.0	18	12	21.5	7	15	35.9
27	Wed		18	6	16.1	11	45.2	17	14.2		4	23	16.7	19	10	39.7	8	12	29.9
28	Thu		19	6	16.8	11	45.4	17	14.0	S	5	21	59.7	20	9	38.4	9	9	57.2
29	Fri		20	6	17.5	11	45.7	17	13.8		6	21	30.3	21	9	22.4	10	8	01.1
30	Sat		21	6	18.1	11	45.9	17	13.6	S	7	21	48.8	22	9	53.3	11	6	42.7
																	(12	30	00.6)

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

Dakshinayan — SAKA ERA 1942

Dakshina Gola — Month of KARTIKA (30 days) — Ayanamsa on 1st : $24^0 08' 34''$

(*Nirayana*) 8 Kartika, 5121 Kali Era to (*Nirayana*) 7 Agrahayana, 5121 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2020 A.D.					
1	Oct. 23	S A U R A K A R T I K A	C H A A N D R A A S V I N A S U D D H A	1- Enters Svati nak. ($24^h 00^m.0$)		1- Durga Puja begins(Saptami), Oli begins.
2	24					2- Saraswati Visarjana, Mahashtami, Maha Navami, Ayudha puja, Trivandrum Arat (Kerala)
3	25				3- Sayana Vyatipata ($21^h 35^m.9$)	3- Mahanavami (Bengal), Dussehara/ Dasahara
	26					
4						4- Vijaya Dasami (Bengal & Kerela), Madhvacharya Jayanti, Bharat Milap
	27					
5						5- Papankusa Ekadasi (Pasaukusa Ekadasi)
	28					
6	29					
7	30					
8						8- Kojagor(Lakshimndra Puja), Kojagori Lakshmi Puja, Sarat Purnima
	31					
9					9- Full Moon ($20^h 19^m.2$)	9- Kumara Purnima (Odisha), Maharshi Valmiki's Birthday, Oli ends(Jain).
	Nov. 1					
10						10- Martyrdom day of Bhagat Kanwar Ram (Sindhi).
	2					
11	3					
12	4					
13	5					13- Karaka Chaturthi, Dasaratha Chaturthi.
14	6					
15				15- Enters Visakha nak. ($8^h 14^m.0$)		
16	7					
17	8				17- Sayana Vaidhriti ($13^h 46^m.6$)	17- Ahoyi Ashtami, Karashtami.
18	9					
19	10					
20	11					20- Rama Ekadasi.
21	12					21- Govatsa Dvadasi.
22	13					22- Dhana Trayodasi, Kali Chaturdasi.
23	14					23- Hanumajjanma (N. India)(Purvarunodaya), Naraka Chaturdasi (Purvarunodaya), Kali Puja,Dipavali, Lakshmi Puja, Kaumudi Dipam, Lakshmi Dipam, Kedar Gauri Vrata (S. India), Mahavira Nirvana(Jain), Children's Day (Nehru's Birthday).
24	15		C H A A N D R A K A R T I K A	24- Saura Margasirshadi ($9^h 37^m.4$)	24- New Moon ($10^h 37^m.2$)	24- Govardhana Puja, Bali Puja, Annakuta.
25	16	SAURA MARGASIRSHA				25- Kartika Sukladi, Yama Dvitiya, Visvakarma Day, Bhratri Dvitiya (Bengal), Dwat Puja (Bihar), Kartika Puja.
26	17					26- Death anniversary of Lala Lajpat Rai.
27	18					
28	19			28- Enters Anuradha nak. ($14^h 12^m.3$)	28- Sayana Vyatipata ($28^h 18^m.3$)	28- Jnana Panchami (Jain)
29	20				29- Jupiter enters Makara ($13^h 22^m.9$)	29- Pratihara Shashthi or Surya Shashthi (Chhat -Bihar), Birthday celebration of Prof. Ram Panjwani (Sindhi)
30	Nov. 21			30- Enters Tropical Sagittarius ($26^h 09^m.7$)		

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters : Makara 1,$07^h 01^m.8$; Kumbha 3, $15^h 26^m.3$;Mina 5, $26^h 30^m.8$; Mesha 8,$14^h 57^m.1$;Vrisha 10, $27^h 41^m.0$; Mithuna 13, $15^h 43^m.2$;Karkata 15, $25^h 48^m.4$;Simha 18, $8^h 42^m.4$;Kanya 20,$12^h 00^m.5$;Tula 22,$12^h 31^m.7$;Vrischika 24,$11^h 58^m.2$;Dhanus 26,$12^h 21^m.5$;Makara 28,$15^h 30^m.1$;Kumbha 30,$22^h 25^m.9$;Sun enters :- Nirayana Vrischika 25, $6^h 54^m.0$.

INDIAN CALENDAR

SAKA ERA 1942

Dhanus : Sahasya
Hemanta, 2nd Month

Month of AGRAHAYANA (30 days)

(*Nirayana*) 8 Agrahayana, 5121 Kali Era to (*Nirayana*) 7 Pausha, 5121 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi			Nakshatra			Yoga		
									No.	Ending Moment		No.	Ending Moment		No.	Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2019 A.D.															
1	Sun	Nov. 22	6	18.8	11	46.2	17	13.5	S 8	22	51.8	23	11	09.2	13	29	50.6
2	Mon	23	6	19.5	11	46.5	17	13.3	9	24	32.8	24	13	04.7	14	30	00.8
3	Tue	24	6	20.2	11	46.7	17	13.2	S 10	26	42.6	25	15	31.7	15	-	-
4	Wed	25	6	20.9	11	47.0	17	13.2	11	29	10.8	26	18	20.3	15	6	44.9
5	Thu	26	6	21.6	11	47.4	17	13.1	12	-	-	27	21	20.4	16	7	34.1
6	Fri	27	6	22.2	11	47.7	17	13.1	12	7	47.0	1	24	22.5	17	8	28.5
7	Sat	28	6	22.9	11	48.0	17	13.1	13	10	21.9	2	27	18.8	18	9	21.8
8	Sun	29	6	23.6	11	48.4	17	13.1	14	12	48.1	3	30	03.1	19	10	08.6
9	Mon	30	6	24.3	11	48.7	17	13.2	S 15	14	59.7	4	-	-	20	10	45.0
10	Tue	Dec. 1	6	25.0	11	49.1	17	13.2	K 1	16	52.3	4	8	30.6	21	11	07.6
11	Wed	2	6	25.6	11	49.5	17	13.3	2	18	22.5	5	10	37.7	22	11	13.8
12	Thu	3	6	26.3	11	49.9	17	13.5	3	19	27.3	6	12	21.3	23	11	01.4
13	Fri	4	6	27.0	11	50.3	17	13.6	4	20	04.1	7	13	38.8	24	10	28.4
14	Sat	5	6	27.7	11	50.7	17	13.8	K 5	20	10.7	8	14	27.6	25	9	32.8
15	Sun	6	6	28.3	11	51.1	17	14.0	6	19	45.4	9	14	45.9	26	8	13.1
															(27	30	28.1)
16	Mon	7	6	29.0	11	51.5	17	14.2	7	18	47.6	10	14	32.5	1	28	17.4
17	Tue	8	6	29.6	11	52.0	17	14.4	8	17	17.7	11	13	47.5	2	25	41.9
18	Wed	9	6	30.3	11	52.4	17	14.7	9	15	17.9	12	12	32.6	3	22	43.2
19	Thu	10	6	30.9	11	52.9	17	15.0	K 10	12	51.8	13	10	51.2	4	19	24.7
20	Fri	11	6	31.5	11	53.3	17	15.3	11	10	04.5	14	8	48.2	5	15	50.4
												(15	30	30.1)			
21	Sat	12	6	32.1	11	53.8	17	15.6	12	7	02.5	16	28	04.5	6	12	05.6
									(13	27	53.2)						
22	Sun	13	6	32.8	11	54.3	17	15.9	14	24	45.0	17	25	40.1	7	8	16.6
															(8	28	29.7)
23	Mon	14	6	33.4	11	54.7	17	16.3	K 30	21	46.6	18	23	25.9	9	24	52.3
24	Tue	15	6	33.9	11	55.2	17	16.7	S 1	19	07.0	19	21	30.9	10	21	31.0
25	Wed	16	6	34.5	11	55.7	17	17.1	2	16	54.9	20	20	04.1	11	18	32.7
26	Thu	17	6	35.1	11	56.2	17	17.5	3	15	18.2	21	19	13.1	12	16	02.9
27	Fri	18	6	35.6	11	56.7	17	17.9	4	14	23.4	22	19	04.0	13	14	06.5
28	Sat	19	6	36.2	11	57.2	17	18.4	S 5	14	14.7	23	19	40.1	14	12	45.9
29	Sun	20	6	36.7	11	57.7	17	18.9	6	14	53.2	24	21	01.2	15	12	01.5
30	Mon	21	6	37.2	11	58.2	17	19.4	S 7	16	15.6	25	23	03.0	16	11	51.0

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

Dakshinayana — SAKA ERA 1942

Dakshina Gola — Month of AGRAHAYANA (30 days) — Ayanamsa on 1st : $24^{0} 08^{/} 38^{//}$

(*Nirayana*) 8 Agrahayana, 5121 Kali Era to (*Nirayana*) 7 Pausha, 5121 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2020 A.D.					
1	Nov. 22	SAURA MARGASIRSHA	CHANDRA KARTIKA			1- Gopashtami or Gosthashtami.
2	23					2- Jagaddhatri Puja, Akshya Navami.
3	24					3- Guru Tegh Bahadur's Martyrdom Day.
4	25					4- Deva Probodhani Ekadasi.
5	26					5- Tulasi Vivaha, Vanjuli Mahadvadasi.
6	27					
7	28					7- Vaikuntha Chaturdasi, Bharani Dipam.
8	29					8- Krittika Dipam, Rasayatra (Smarta), Tripurotsava.
9	30				9- Full Moon ($15^h 00^m.0$)	9- Rasayatra (Vaishnava), Kartiki Purnima, Rathayatra (Jain), Guru Nanak's Birthday, Pushkar Fair (Ajmer), Huthri-3 days(Coorg).
10	Dec. 1					
11	2			11- Enters Jyeshtha nak. ($18^h 33^m.6$)		
12	3				12- Sayana Vaidhriti ($19^h 53^m.6$)	
13	4					
14	5					
15	6					
16	7					16- Kalashtami.
17	8					17- Prathamashtami (Odisha), Vaikkatashtami (Kerela).
18	9					
19	10					
20	11					20- Utpanna Ekadasi.
21	12					
22	13					
23	14			23- Saura Paushadi ($24^h 25^m.9$)	23- New Moon ($21^h 46^m.6$) 23- Total Solar Eclipse (not visible in India)	
24	15	SAURA PAUSHA	CHANDRA MARGASIRSHA	24- Enters Mula nak. ($21^h 32^m.3$)	24- Sayana Vyatipata ($19^h 02^m.6$)	
25	16					
26	17					
27	18					
28	19					28- Subrahmanya Shasthi (South India).
29	20					29- Guha Shashthi, Champa Shasthi (Maharashtra), Mulukrupini Shashthi.
30	Dec. 21			30- Enters Trop. Capricorn ($15^h 32^m.3$)		30- Mitra Saptami, Uttarayana Day.

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Mina 3, $8^h 52^m.5$; Mesha 5, $21^h 20^m.4$; Vrisha 8, $10^h 01^m.2$; Mithuna 10, $21^h 36^m.9$; Karkata 13, $7^h 22^m.0$; Simha 15, $14^h 45^m.9$; Kanya 17, $19^h 31^m.5$; Tula 19, $21^h 52^m.0$; Vrischika 21, $22^h 41^m.1$; Dhanus 23, $23^h 25^m.9$; Makara 25, $25^h 47^m.7$; Kumbha 28, $7^h 16^m.3$; Mina 30, $16^h 29^m.1$; <u>Sun enters :- Nirayana Dhanus 24, $21^h 32^m.3$.</u>

INDIAN CALENDAR

SAKA ERA 1942

Makara : Tapas
Winter (Sisira), 1st Month

Month of PAUSHA (30 days)

(*Nirayana*) 8 Pausha, 5121 Kali Era to (*Nirayana*) 7 Magha, 5121 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi No.	Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2020 A.D.															
1	Tue	Dec. 22	6	37.7	11	58.7	17	19.9	S 8	18	14.8	26	25	37.4	17	12	09.3
2	Wed	23	6	38.2	11	59.2	17	20.4	9	20	39.9	27	28	32.8	18	12	48.8
3	Thu	24	6	38.6	11	59.7	17	21.0	S 10	23	17.7	1	-	-	19	13	40.7
4	Fri	25	6	39.1	12	00.2	17	21.5	11	25	54.7	1	7	36.3	20	14	35.5
5	Sat	26	6	39.5	12	00.7	17	22.1	12	28	18.8	2	10	35.3	21	15	24.4
6	Sun	27	6	39.9	12	01.2	17	22.7	13	30	20.8	3	13	19.0	22	15	59.9
7	Mon	28	6	40.3	12	01.6	17	23.3	14	-	-	4	15	39.5	23	16	16.7
8	Tue	29	6	40.7	12	02.1	17	23.9	14	7	54.8	5	17	32.1	24	16	11.5
9	Wed	30	6	41.0	12	02.6	17	24.5	S 15	8	58.2	6	18	55.0	25	15	42.9
10	Thu	31	6	41.3	12	03.1	17	25.1	K 1	9	30.7	7	19	48.8	26	14	51.0
		2021 A.D.															
11	Fri	Jan. 1	6	41.6	12	03.6	17	25.8	2	9	33.9	8	20	15.2	27	13	36.9
12	Sat	2	6	41.9	12	04.0	17	26.4	3	9	10.4	9	20	16.9	1	12	02.5
13	Sun	3	6	42.2	12	04.5	17	27.1	4	8	22.9	10	19	56.6	2	10	09.6
14	Mon	4	6	42.4	12	04.9	17	27.7	5	7	14.3	11	19	17.0	3	8	00.4
									(6	29	47.3)				4	29	36.6
15	Tue	5	6	42.7	12	05.4	17	28.4	7	28	04.2	12	18	20.6	5	27	00.0
16	Wed	6	6	42.9	12	05.8	17	29.1	8	26	07.0	13	17	09.4	6	24	12.2
17	Thu	7	6	43.1	12	06.3	17	29.8	9	23	58.3	14	15	45.8	7	21	14.8
18	Fri	8	6	43.2	12	06.7	17	30.5	K 10	21	40.6	15	14	12.4	8	18	10.0
19	Sat	9	6	43.4	12	07.1	17	31.2	11	19	17.5	16	12	32.3	9	15	00.3
20	Sun	10	6	43.5	12	07.5	17	31.9	12	16	53.1	17	10	49.6	10	11	49.0
21	Mon	11	6	43.6	12	07.9	17	32.6	13	14	32.9	18	9	09.3	11	8	39.8
															(12	29	37.5)
22	Tue	12	6	43.6	12	08.3	17	33.3	14	12	23.0	19	7	37.7	13	26	47.2
												(20	30	21.5)			
23	Wed	13	6	43.7	12	08.7	17	34.0	K 30	10	30.2	21	29	28.0	14	24	14.4
24	Thu	14	6	43.7	12	09.1	17	34.7	S 1	9	01.9	22	29	04.4	15	22	04.5
25	Fri	15	6	43.7	12	09.4	17	35.4	2	8	05.2	23	29	16.8	16	20	22.2
26	Sat	16	6	43.7	12	09.8	17	36.2	3	7	46.2	24	30	09.3	17	19	11.1
27	Sun	17	6	43.6	12	10.1	17	36.9	4	8	08.9	25	-	-	18	18	32.8
28	Mon	18	6	43.5	12	10.4	17	37.6	S 5	9	14.4	25	7	43.0	19	18	26.2
29	Tue	19	6	43.5	12	10.7	17	38.3	6	10	59.2	26	9	54.6	20	18	47.5
30	Wed	20	6	43.3	12	11.0	17	39.0	S 7	13	15.5	27	12	36.3	21	19	29.7

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1942

Uttarayana
Dakshina Gola

Month of PAUSHA (30 days)

Ayanamsa on 1st : 24° 08′ 44″

(*Nirayana*) 8 Pausha, 5121 Kali Era to (*Nirayana)* 7 Magha, 5121 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2020 A.D.	SAURA PAUSHA	CHANDRA MARGASIRSHA			
1	Dec. 22					
2	23					
3	24					
4	25					4- Mauna Ekadasi (Jain), Gita jayanti, Vaikuntha Ekadasi (S India), Mokshada Ekadasi, Birthday of Sadhu T. L.Vaswani (Sindhi)
5	26					5- Akhanda Dvadasi, Jor mela-3days (Punjab)
6	27					
7	28			7- Enters Purvashadha nak. ($23^h 45^m.0$)	7- Sayana Vaidhriti ($25^h 20^m.4$)	
8	29					8- Shri Dutta Jayanti(Maharashtra), Dutts Treya Jayanti.
9	30				9- Full Moon ($8^h 58^m.2$)	9- Margi Purnima, Arudra Darshanam (Purvarunodaya) (S. India)
10	31					
	2021A.D.					
11	Jan. 1					
12	2					
13	3					
14	4					
15	5					
16	6					16- Ashtaka(Pupashtaka)
17	7					
18	8					18- Birthday of Parsvanath (Jain).
19	9					19- Saphla Ekadasi.
20	10			20- Enters Uttarashadha nak. ($25^h 45^m.4$)	20- Sayana Vyatipata ($9^h 16^m.9$)	
21	11					
22	12					22- Vahula Amavasya (Odisha).
23	13		CHAANDRA PAUSHA	23- Saura Maghadi ($11^h 08^m.0$)	23- New Moon ($10^h 30^m.2$)	23- Lohri (Punjab,J&K), Bhogi (S. India).
24	14	SAURA MAGHA				24- Birthday of Sant Paramanand (Sindhi), Magha Bihu (Assam), Makara Samkranti (N.India), Makara Samkranti(Bengal), Pongal (S. India), Makara Snana,Tila Samkranti, Tai Pongal(Kerala), Tamil New Year's Day.
25	15					25- Mattu Pongal or Kanuvu(S. India)
26	16					
27	17				27- Jupiter sets in the East ($26^h 45^m$)	
28	18					
29	19			29- Enters Tropical Aquarius ($26^h 09^m.8$)		
30	Jan. 20					30- Guru Govind Singh's Birthday.

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Mesha 2, $28^h 32^m.8$; Vrisha 5, $17^h 18^m.0$; Mithuna 7, $28^h 39^m.5$; Karkata 10, $13^h 38^m.0$; Simha 12, $20^h 16^m.9$; Kanya 14, $25^h 04^m.4$; Tula 16, $28^h 29^m.1$; Vrischika 19, $6^h 57^m.7$; Dhanus 21, $9^h 09^m.3$; Makara 23, $12^h 05^m.7$; Kumbha 25, $17^h 05^m.9$; Mina 27, $25^h 15^m.9$; Mesha 30, $12^h 36^m.3$; Sun enters :- Nirayana Makara 24, $8^h 14^m.9$.

INDIAN CALENDAR

SAKA ERA 1942

Kumbha : Tapasya

Month of MAGHA (30 days)

Winter (Sisira), 2nd Month

(*Nirayana*) 8 Magha, 5121 Kali Era to (*Nirayana*) 7 Phalguna, 5121 Kali Era

Date	Week Day	Gregorian Date		Sunrise		Apparent Noon		Sunset		Tithi No.		Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
				h	m	h	m	h	m			h	m		h	m		h	m
		2021 A.D.																	
1	Thu	Jan.	21	6	43.2	12	11.3	17	39.7	S	8	15	50.7	1	15	36.3	22	20	23.4
2	Fri		22	6	43.0	12	11.6	17	40.4		9	18	29.6	2	18	40.1	23	21	18.0
3	Sat		23	6	42.8	12	11.8	17	41.2	S	10	20	56.7	3	21	32.5	24	22	02.8
4	Sun		24	6	42.6	12	12.1	17	41.9		11	22	58.4	4	24	00.8	25	22	28.3
5	Mon		25	6	42.4	12	12.3	17	42.6		12	24	25.0	5	25	55.5	26	22	27.8
6	Tue		26	6	42.1	12	12.5	17	43.2		13	25	11.6	6	27	11.7	27	21	57.2
7	Wed		27	6	41.8	12	12.7	17	43.9		14	25	17.7	7	27	49.1	1	20	55.6
8	Thu		28	6	41.5	12	12.9	17	44.6	S	15	24	46.2	8	27	50.5	2	19	24.2
9	Fri		29	6	41.2	12	13.1	17	45.3	K	1	23	42.4	9	27	21.2	3	17	26.7
10	Sat		30	6	40.9	12	13.3	17	46.0		2	22	13.0	10	26	28.0	4	15	07.5
11	Sun		31	6	40.5	12	13.4	17	46.7		3	20	25.1	11	25	17.9	5	12	31.8
12	Mon	Feb.	1	6	40.1	12	13.6	17	47.3		4	18	25.3	12	23	57.4	6	9	44.8
13	Tue		2	6	39.7	12	13.7	17	48.0	K	5	16	19.6	13	22	32.4	7	6	51.4
																	(8	27	55.5)
14	Wed		3	6	39.2	12	13.8	17	48.6		6	14	12.6	14	21	07.3	9	25	00.2
15	Thu		4	6	38.8	12	13.9	17	49.3		7	12	07.9	15	19	45.3	10	22	07.8
16	Fri		5	6	38.3	12	14.0	17	49.9		8	10	07.7	16	18	28.3	11	19	19.7
17	Sat		6	6	37.8	12	14.0	17	50.5		9	8	13.5	17	17	17.7	12	16	36.7
										(K	10	30	26.5)						
18	Sun		7	6	37.3	12	14.1	17	51.2		11	28	48.0	18	16	14.6	13	13	59.9
19	Mon		8	6	36.8	12	14.1	17	51.8		12	27	20.0	19	15	20.8	14	11	30.4
20	Tue		9	6	36.2	12	14.2	17	52.4		13	26	05.8	20	14	38.6	15	9	10.1
21	Wed		10	6	35.7	12	14.2	17	53.0		14	25	09.4	21	14	11.9	16	7	01.3
																	(17	29	07.4)
22	Thu		11	6	35.1	12	14.2	17	53.6	K	30	24	35.7	22	14	05.0	18	27	32.1
23	Fri		12	6	34.5	12	14.2	17	54.2	S	1	24	30.0	23	14	23.2	19	26	19.2
24	Sat		13	6	33.8	12	14.2	17	54.8		2	24	57.0	24	15	11.3	20	25	31.7
25	Sun		14	6	33.2	12	14.1	17	55.4		3	25	59.5	25	16	32.8	21	25	11.4
26	Mon		15	6	32.5	12	14.1	17	55.9		4	27	37.5	26	18	28.8	22	25	18.1
27	Tue		16	6	31.9	12	14.0	17	56.5	S	5	29	46.7	27	20	56.5	23	25	48.8
28	Wed		17	6	31.2	12	14.0	17	57.0		6	-	-	1	23	48.8	24	26	37.4
29	Thu		18	6	30.5	12	13.9	17	57.6		6	8	18.2	2	26	54.0	25	27	35.2
30	Fri		19	6	29.7	12	13.8	17	58.1	S	7	10	58.7	3	29	57.4	26	28	31.3

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

Uttarayana | SAKA ERA 1942
Dakshina Gola | Month of MAGHA (30 days) | Ayanamsa on 1st : 24° 08′ 48″

(*Nirayana*) 8 Magha, 5121 Kali Era to (*Nirayana*) 7 Phalguna, 5121 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2021 A.D.					
1	Jan. 21	SAURA MAGHA	CHANDRA PAUSHA			1- Martyrdom Day of Hemu Kalani (Sindhi).
2	22				2- Sayana Vaidhriti ($30^h 40^m.5$)	
3	23			3- Enters Sravana nak. ($27^h 59^m.1$)		3- Samba Dasami (Odisha), Netaji's Birthday.
4	24					4- Putrada Ekadasi.
5	25					
6	26					6- Republic Day.
7	27					
8	28				8- Full Moon ($24^h 46^m.2$)	8- Paushi Purnima, Pusyabhisheka Yatra, Floating Festival/Tai Poosam, Birthday of Lala Lajpat Rai.
9	29					
10	30					10- Martyr's Day (Mahatma Gandhi Commemoration Day)
11	31					11- Ganesha Sankastha Chaturthi.
12	Feb. 1					
13	2					
14	3					
15	4				15- Sayana Vyatipata ($19^h 33^m.4$)	15- Birthday of Swami Vivekananda (according to tithi), Astaka (Mamashtaka)
16	5					
17	6			17- Enters Dhanishtha nak. ($7^h 12^m.1$)		
18	7					18- Sattila Ekadasi (Smarta).
19	8					19- Sattila Ekadasi (Vaishnava and Vidhava).
20	9					20- Meru Trayodasi (Jain).
21	10					21- Ratanti Kalika Puja.
22	11			22- Saura Phalgunadi ($23^h 54^m.2$)	22- New Moon ($24^h 35^m.7$)	22- Mauni Amavasya, Tai Amavasya, Makara Vavu (Kerala).
23	12	SAURA PHALGUNA	CHANDRA MAGHA			23- Magha Sukladi.
24	13				24- Jupiter rises in the West ($10^h 06^m$)	
25	14					
26	15					26- Varada Chaturthi, Tila Chaturthi, Kunda Chaturthi, Ganesa Puja (Bengal).
27	16					27- Sri Panchami, Saraswati Puja, Vasanta Panchami.
28	17				28- Venus sets in the West ($10^h 10^m$) 28- Sayana Vaidhriti ($11^h 10^m.6$)	
29	18			29- Enters Trop. Pisces ($16^h 13^m.9$)		29- Arogya Saptami, Vidhana Saptami.
30	Feb. 19			30- Enters Satabhisaj nak. ($11^h 37^m.0$)		30- Shivaji Jayanti, Ratha Saptami (Purvarunodaya).

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Vrisha 2, $25^h 24^m.8$; Mithuna 5, $13^h 02^m.7$; Karkata 7, $21^h 43^m.3$; Simha 9, $27^h 21^m.2$; Kanya 12, $6^h 58^m.5$; Tula 14, $9^h 49^m.7$; Vrischika 16, $12^h 47^m.0$; Dhanus 18, $16^h 14^m.6$; Makara 20, $20^h 30^m.3$; Kumbha 22, $26^h 10^m.6$; Mina 25, $10^h 09^m.1$; Mesha 27, $20^h 56^m.5$; Vrisha 30, $9^h 40^m.6$;

Sun enters :- Nirayana Kumbha 23, $21^h 12^m.4$.

INDIAN CALENDAR

SAKA ERA 1942

Mina : Madhu

Spring (Vasanta), 1st Month

Month of PHALGUNA (30 days)

(*Nirayana*) 8 Phalguna, 5121 Kali Era to (*Nirayana*) 7 Chaitra, 5121 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi No.	Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2021 A.D.															
1	Sat	Feb. 20	6	29.0	12	13.7	17	58.7	S 8	13	32.2	4	-	-	27	29	14.3
2	Sun	21	6	28.3	12	13.6	17	59.2	9	15	42.7	4	8	43.4	1	29	34.0
3	Mon	22	6	27.5	12	13.5	17	59.7	S 10	17	16.8	5	10	57.8	2	29	22.2
4	Tue	23	6	26.7	12	13.3	18	00.2	11	18	05.7	6	12	30.8	3	28	34.2
5	Wed	24	6	25.9	12	13.2	18	00.7	12	18	06.0	7	13	17.2	4	27	08.6
6	Thu	25	6	25.1	12	13.0	18	01.2	13	17	19.1	8	13	17.2	5	25	07.3
7	Fri	26	6	24.3	12	12.9	18	01.7	14	15	50.2	9	12	35.1	6	22	34.7
8	Sat	27	6	23.5	12	12.7	18	02.1	S 15	13	47.3	10	11	18.2	7	19	36.9
9	Sun	28	6	22.6	12	12.5	18	02.6	K 1	11	19.4	11	9	35.6	8	16	21.1
10	Mon	Mar. 1	6	21.8	12	12.3	18	03.1	2	8	36.1	12	7	36.9	9	12	54.7
									(3	29	46.7)	(13	29	31.8)			
11	Tue	2	6	20.9	12	12.1	18	03.5	4	26	59.7	14	27	29.0	10	9	24.9
															(11	29	58.1)
12	Wed	3	6	20.0	12	11.9	18	04.0	K 5	24	22.1	15	25	35.7	12	26	39.7
13	Thu	4	6	19.2	12	11.7	18	04.4	6	21	59.3	16	23	57.4	13	23	33.9
14	Fri	5	6	18.3	12	11.5	18	04.9	7	19	54.9	17	22	37.6	14	20	43.1
15	Sat	6	6	17.4	12	11.2	18	05.3	8	18	10.8	18	21	38.0	15	18	08.7
16	Sun	7	6	16.5	12	11.0	18	05.7	9	16	47.5	19	20	59.0	16	15	51.0
17	Mon	8	6	15.6	12	10.8	18	06.2	K 10	15	44.9	20	20	40.3	17	13	49.9
18	Tue	9	6	14.6	12	10.5	18	06.6	11	15	02.6	21	20	41.4	18	12	04.9
19	Wed	10	6	13.7	12	10.3	18	07.0	12	14	40.7	22	21	02.7	19	10	35.9
20	Thu	11	6	12.8	12	10.0	18	07.4	13	14	40.3	23	21	45.3	20	9	23.6
21	Fri	12	6	11.8	12	09.7	18	07.8	14	15	03.0	24	22	51.0	21	8	29.1
22	Sat	13	6	10.9	12	09.5	18	08.2	K 30	15	51.2	25	24	21.9	22	7	53.7
23	Sun	14	6	09.9	12	09.2	18	08.6	S 1	17	06.7	26	26	19.5	23	7	39.1
24	Mon	15	6	09.0	12	08.9	18	09.0	2	18	50.0	27	28	43.5	24	7	45.7
25	Tue	16	6	08.0	12	08.6	18	09.4	3	20	59.4	1	-	-	25	8	13.1
26	Wed	17	6	07.1	12	08.3	18	09.8	4	23	29.2	1	7	30.8	26	8	58.3
27	Thu	18	6	06.1	12	08.1	18	10.2	S 5	26	10.0	2	10	34.5	27	9	56.2
28	Fri	19	6	05.1	12	07.8	18	10.6	6	28	48.7	3	13	44.0	1	10	58.8
29	Sat	20	6	04.1	12	07.5	18	10.9	7	-	-	4	16	45.5	2	11	56.6
30	Sun	21	6	03.2	12	07.2	18	11.3	S 7	7	10.5	5	19	24.5	3	12	38.7

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

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INDIAN CALENDAR

SAKA ERA 1942

Uttarayana
Dakshina Gola

Month of PHALGUNA (30 days)

Ayanamsa on 1st : $24^0 08^{/} 53^{//}$

(*Nirayana*) 8 Phalguna, 5121 Kali Era to (*Nirayana)* 7 Chaitra, 5121 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2021 A.D.					
1	Feb. 20	SAURA PHALGUNA	CHANDRA MAGHA			1- Bhishmashtami.
2	21					
3	22					
4	23					4- Jaya Ekadasi, Bhaimi Ekadasi (Bengal).
5	24					5- Bhishma Dvadasi.
6	25					6- Desert Festival - 3 days (Jaislmer).
7	26					
8	27				8- Full Moon ($13^h 47^m.3$)	8- Guru Rabi Das's Birthday (according to tithi), Maghi Purnima Masi Magham.
9	28					
10	Mar. 1					
11	2				11- Sayana Vyatipata ($6^h 54^m.5$)	
12	3					
13	4			13- Enters Purva Bhadrapada nak. ($17^h 59^m.7$)		
14	5					14- Vaikkatashtami (Kerela).
15	6					15- Ashtaka (Sakashtak), Janaki Janma.
16	7					
17	8					17- Birthday of Swami Dayananda Saraswati (Founder of Arya Samaj).
18	9					18- Vijaya Ekadasi.
19	10					19- Maha Sivratri (Kashmir).
20	11					20- Maha Sivaratri, Maha Sivaratri (S. India).
21	12					
22	13			22- Saura Chaitradi ($20^h 26^m.0$)	22- New Moon ($15^h 51^m.2$)	
23	14		CHAANDRA PHALGUNA		23- Sayana Vaidhriti ($16^h 45^m.5$)	
24	15	SAURA CHAITRA				24- Birthday of Sri Ramakrishna (according to tithi).
25	16					
26	17			26- Enters Uttara Bhadrapada nak. ($26^h 21^m.6$)		
27	18					
28	19					
29	20			29- Enters Trop. Aries ($15^h 07^m.4$)		29- Mahavishuva Day.
30	Mar. 21					30- Indian Year Ending day, Holastaka

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of $82½^0$ E. Long.

Moon enters :- Mithuna 2, $21^h 55^m.3$; Karkata 5, $7^h 10^m.1$; Simha 7, $12^h 35^m.1$; Kanya 9, $15^h 07^m.0$; Tula 11, $16^h 29^m.7$; Vrischika 13, $18^h 20^m.4$; Dhanus 15, $21^h 38^m.0$; Makara 17, $26^h 38^m.7$; Kumbha 20, $9^h 21^m.2$; Mina 22, $17^h 56^m.7$; Mesha 24, $28^h 43^m.5$; Vrisha 27, $17^h 21^m.9$; Mithuna 30, $6^h 08^m.7$; Sun enters: Nirayana Mina 23, $18^h 03^m.6$.

PRINCIPAL FESTIVALS AND ANNIVERSARIES FOR HOLIDAYS

Festivals	Criterion	Date
		National / Nirayana / Gregorian
		Saka 1941/Kali 5120 /2020 A.D.
77. Guru Gobind Singh's Birthday	Pausha S 7	Pausha 12 / Pausha 19 / Jan 02
78. Vaikuntha Ekadasi (S.India)	S 11 of Saura Pausha	Pausha 16 / Pausha 23 / Jan 06
79. Bhogi (S.India)	Day before Pongal	Pausha 24 / Magha 1 / Jan.14
80. Makara Samkranti (Bengal)	Saura Maghadi (Midnight Rule)	Pausha 25 / Magha 2 / Jan 15
Magha Bihu (Assam)	Saura Maghadi (Midnight Rule)	Pausha 25 / Magha 2 / Jan. 15
81. Pongal (S.India),Tai Pongal(Kerala)	The day of Saura Maghadi	Pausha 25 / Magha 2 / Jan. 15
Tamil New Year's day ,Tila Samkranti,	(Sunset Rule)	Pausha 25 / Magha 2 / Jan. 15
Makara Samkranti (N.India), Makaradi Snana	-do-	Pausha 25 / Magha 2 / Jan. 15
82. Mattu Pongal or Kanuvu	Day after Pongal	Pausha 26 / Magha 3 / Jan. 16
83. Netaji's Birthday	Fixed	Magha 3 / Magha 10 / Jan. 23
84. Republic Day	Fixed	Magha 6 / Magha 13 / Jan. 26
85. Sri Panchami, Vasanta Panchami	Magha S 5	Magha 10 / Magha 17 / Jan 30
86. Guru Ravidas's Birthday	Magha S 15	Magha 20 / Magha 27 / Feb 9
87. Birth Day of Swami Dayananda Saraswati (Founder of Arya Samaj)	Phalguna K 10 (Purnimanta)	Magha 29 / Phalguna 6 / Feb 18
88. Sivaji Jayanti	Fixed	Magha 30 / Phalguna 7 / Feb 19
89. Maha Sivaratri (Kashmir)	Magha K 13	Phalguna 1/ Phalguna 8/ Feb 20
90. Maha Sivaratri	Magha K 14(Prodosa & Nishithavyapini)	Phalguna 2/ Phalguna 9/ Feb 21
91. Holikadahana	Phalguna S 15 (night)	Phalguna 19/ Phalguna 26/ March 9
92. Dolyatra	Phalguna S 15	Phalguna 19/ Phalguna 26/ March 9
93. Holi	Day after Holikadahana	Phalguna 20/Phalguna 27/March 10
94. Hola,Vasantotsava	Phalguna K 1	Phalguna 20/Phalguna 27/March 10
95. MahaVishuva day .	Day of Sun's entry into Trop . Aries (Midnight rule)	Phalguna 30 / Chaitra 6 / March 20
		Saka 1942/Kali 5120 /2020 A.D.
1. Indian New Year's Day	Fixed	Chaitra 1 / Chaitra 7/ Mar. 21
2. Chaitra Shukladi(Gudi Padava, Ugadi),	Chaitra S 1	Chaitra 5 / Chaitra 11/ Mar. 25
Cheti Chand (Sindhi New Year's Day),	Chaitra S 1	Chaitra 5 / Chaitra 11/ Mar. 25
Vasanta Navaratrarambha, Telugu	Chaitra S 1	Chaitra 5 / Chaitra 11/ Mar. 25
New Year's Day	Chaitra S 1	Chaitra 5 / Chaitra 11/ Mar. 25
3. Sarhul (Bihar)	Chaitra S 3	Chaitra 7 / Chaitra 13/ Mar. 27
4. Oli begins (Jain)	Chaitra S 7	Chaitra 11 / Chaitra 17/ Mar. 31
5. Rama Navami	Chaitra S 9	Chaitra 13 / Chaitra 19/ Apr. 2
6. Mahavira Jayanti	Chaitra S 13	Chaitra 17 / Chaitra 23/ Apr. 6
7. Oli ends (Jain)	Chaitra S 15(Udayvyapini)	Chaitra 19 / Chaitra 25 / April 8
8. Vaisakhi (Punjab,Haryana, H.P,Delhi	Saura Vaisakhadi(Sunrise Rule)	Chaitra 24 / Chaitra 30 / April 13
& Odisha),Visu (Kerala),	Saura Vaisakhadi(Sunrise Rule)	Chaitra 24 / Chaitra 30 / April 13
Chaitra Samkranti,	Saura Vaisakhadi(Midnight Rule)	Chaitra 24 / Chaitra 30 / April 13
Chadak Puja(Bengal),	Saura Vaisakhadi(Midnight Rule)	Chaitra 24 / Chaitra 30 / April 13
Cheiraoba (Manipur),	Day of Saura Vaisakhadi	Chaitra 24 / Chaitra 30 / April 13
Mesha Samkranti (Odisha),	Saura Vaisakhadi (Sunrise Rule)	Chaitra 24 / Chaitra 30 / April 13
Rangali Bihu(Assam)		Chaitra 24 / Chaitra 30 / April 13
		Saka 1942/Kali 5121 /2020 A.D.
9. Vaisakhadi (Bengal) , Bahag Bihu	Day Following Saura Vaisakhadi	Chaitra 25/ Vaisakha 1 / Apr. 14
(Assam), Shilhenba (Manipur),	(Midnight Rule)	Chaitra 25/ Vaisakha 1 / Apr. 14
Meshadi (T.N.),	Saura Vaisakhadi (Sunset Rule)	Chaitra 25/ Vaisakha 1 / Apr. 14
Dr. B. R. Ambedkar Jayanti	Fixed	Chaitra 25/ Vaisakha 1 / Apr. 14
10. Babu Kuer Singh Day (Bihar),	Fixed	Vaisakha 3 / Vaisakha 10 /Aprl.23
Tithi of Deva Damodara(Assam)	S1 of Saura Vaisakha	Vaisakha 3 / Vaisakha 10 /Aprl.23
11. Akshaya Tritiya	Vaisakha S 3	Vaisakha 6 / Vaisakha 13 /April 26
12. May Day	Fixed	Vaisakha 11 / Vaisakha 18 / May 1
13. Buddha Purnima	Vaisakha S 15	Vaisakha 17/ Vaisakha 24 / May 7

Festivals numbered 77 to 95 are repetition of the same for Pausha to Phalguna, 1941 S.E., published in the previous year.

PRINCIPAL FESTIVALS AND ANNIVERSARIES FOR HOLIDAYS

Festivals	Criterion	Date
		National / Nirayana / Gregorian Saka 1942/Kali 5121/2020 A.D.
14. Birthday of Rabindranath	25 Vaisakha of Beng. Calendar	Vaisakha 18 / Vaisakha 25 /May 8
15. Pratap Jaynati	Jyaishtha S 3	Jyaishtha 4/Jyaishtha 11/ May 25
16.Guru Arjan Dev's Martyrdom Day (Sikh)	Jyaishtha S 4	Jyaishtha 5/Jyaishtha 12/ May 26
17. Rajas Samkranti (Odisha)	Saura Ashadhadi (Sunrise Rule)	Jyaishtha 24/Jyaishtha 31/June14
18. Rathayatra	Ashadha S 2	Ashadha 2/ Ashadha 9 / June 23
19. Kharchi Puja (Tripura)	Ashadha S 8	Ashadha 7/ Ashadha 14/June 28
20. Punaryatra (Smarta)	Ashadha S 10	Ashadha 9/ Ashadha 16/June 30
21. Ultarath, Bahudha Yatra	9th day from Rathyatra	Ashadha 10/ Ashadha 17/ July1
22. Ker Puja (Tripura)	First Tues. or Sat.day after 14 days from Kharchi Puja not falling on K 10	Ashadha 23/ Ashadha 30/July 14
23. Karkataka Vavu (Kerela)	K 30 of Saura Sravana	Ashadha 29/ Sravana 5/ July 20
24. Jhulana Yatrarambha	Sravana S 11	Sravana 8 / Sravana 15 / July 30
25. Tilak Commemoration Day	Fixed	Sravana 10/ Sravana 17/ Aug 1
26. Raksha Bandhana , Amar nath yatra,	Sravana S 15	Sravana 12 / Sravana 19 / Aug 3
Solono (Rakhi Bandhan), Naroli	Sravana S 15	Sravana 12 / Sravana 19 / Aug 3
Purnima, Balabhadra Puja (Odisha),	Sravana S 15	Sravana 12 / Sravana 19 / Aug 3
Sravani Purnima, Avani Avittam	Sravana S 15	Sravana 12 / Sravana 19 / Aug 3
(S. India), Jaju Upakarma,	Sravana S 15	Sravana 12 / Sravana 19 / Aug 3
Jhulana Yatrasamapanna	Sravana S 15	Sravana 12 / Sravana 19 / Aug 3
27. Rik Upakarma	Sravana nak . of Chandra Sravana	Sravana 13 / Sravana 20 / Aug. 4
28. Raksha Panchami (Odisha)	Sravana K 5	Sravana 17 / Sravana 24 / Aug.8
29. Janmashtami (Smarta)	Sravana K 8 (Nishitha)	Sravana 20 / Sravana 27 / Aug. 11
30. Janmashtami (Vaishnava),	Sravana K 8	Sravana 21 / Sravana 28 / Aug.12
Gokulashtami (Nandotsava)	Sravana K 8	Sravana 21 / Sravana 28 / Aug.12
31. Independence Day,	Fixed	Sravana 24 / Sravana 31 / Aug.15
Paryusana Parvarambha (Chaturthi Paksha –Jain)	7 days before Samvatsari (Chaturthi paksha)	Sravana 24 / Sravana 31 / Aug.15
32. Paryusana Parvarambha (Panchami Paksha –Jain)	7 days before Samvatsari (Panchami paksha)	Sravana 25 / Bhadra 1 / Aug.16
33. Vinayak Chaturthi (T.N),Ganesh	S4 of Saura Bhadra	Sravana 31 / Bhadra 7 / Aug.22
Chaturthi, Samvatsari(Chaturthi paksha - Jain),	Bhadra S 4 (Udayavyapini)	Sravana 31 / Bhadra 7 / Aug.22
Sama Veda Upakarma	Hasta in Chandra Bhadra	Sravana 31 / Bhadra 7 / Aug.22
34. Samvatsari(Panchami paksha - Jain)	Bhadra S 5 current at Sunset	Bhadra 1/ Bhadra 8/ Aug 23
35. Radhashtami	Bhadra S 8	Bhadra 4/ Bhadra 11/ Aug 26
36. First Onam Day	Day before Thiru Onam Day	Bhadra 8/ Bhadra 15/ Aug 30
37. Onam or Thiru Onam Day	Sravana nak.of Saura Bhadra	Bhadra 9/ Bhadra 16/ Aug 31
38. Ananta Chaturdasi	Bhadra S 14	Bhadra 10/ Bhadra 17/ Sept 1
Third Onam day	Day after Thiru Onam day	Bhadra 10/ Bhadra 17/ Sept 1
39. Fourth Onam day	2 days after Thiru Onam day	Bhadra 11/ Bhadra 18/ Sept 2
40. Tithi of Sri Madhava Deva (Assam)	K 5 of Saura Bhadra	Bhadra 16/ Bhadra 23/ Sept 7
41. Sri Krishna Jayanti (T.N., Kerala, Assam),	K8 of Saura Bhadra	Bhadra 19/ Bhadra 26/ Sept 10
Sri Jayanti (Ramanuja).	Rohini Nakshatra of Saura Bhadra	Bhadra 19/ Bhadra 26/ Sept 10
42. Mahalaya Amavasya ,Sarvapitri Amavasya (Odisha)	Bhadra K 30	Bhadra 26 / Asvina 2 / Sept 17
43. Mahatma Gandhi's Birthday	Fixed	Asvina 10/ Asvina 17 / Oct 2
44. Sthapana Navaratrarambha (Saradia)	Asvina S1	Asvina 25 / Kartika 2 /Oct 17
45. Durga Puja (Saptami)	Asvina S 7	Kartika 1/ Kartika 8 /Oct 23
Oli begins (Jain)	8 days before Oli ends	Kartika 1/ Kartika 8 /Oct 23
46. Durga Puja (Maha Astami),	Asvina S 8	Kartika 2/ Kartika 9 /Oct 24
Durga Puja (Maha Navami),	Asvina S 9	Kartika 2/ Kartika 9 /Oct 24
Trivandram Arat	Sravana Nakshatra of Saura Kartika	Kartika 2/ Kartika 9 /Oct 24
47. Ayudha Puja, Mahanavami	Day before Vijaya Dasami	Kartika 3/ Kartika 10 /Oct 25
(Bengal & Kerela),	Day before Vijaya Dasami	Kartika 3 /Kartika 10 /Oct 25
Dussehara or Dasahara	Asvina S 10 (Aparahnavyapini) with Sravana Nakshatra	Kartika 3/ Kartika 10 /Oct 25
48. Vijaya Dasami (Bengal & kerala)	Asvina S 10	Kartika 4 / Kartika 11 / Oct 26
49. Kojagori Lakshmi Puja (Bengal)	Asvina S 15 (Pradosa)	Kartika 8 / Kartika 15 / Oct 30
50. Kumara Purnima (Odisha)	Asvina S 15	Kartika 9 / Kartika 16 / Oct 31
Maharsi Valmiki's Birthday (according	Asvina S 15 (Udayavyapini)	Kartika 9 / Kartika 16 / Oct 31
to tithi), Oli ends	Asvina S 15 (Udayavyapini)	Kartika 9 / Kartika 16 / Oct 31

PRINCIPAL FESTIVALS AND ANNIVERSARIES FOR HOLIDAYS

Festivals	Criterion	Date
		National / Nirayana / Gregorian **Saka 1942/Kali 5121/2020 A.D.**
51. Naraka Chaturdasi (Purvarunodaya) (S. India)	Asvina K 14(Purvarunodaya)	Kartika 23/ Kartika 30 /Nov. 14
Kali Puja,	Asvina K 30(Nisithavyapini)	Kartika 23/ Kartika 30 /Nov. 14
Dipavali	Asvina K 14	Kartika 23/ Kartika 30 /Nov. 14
52. Govardhan Puja,	Kartika S 1	Kartika 24 / Agrahn.1 / Nov 15
Bali Puja	Kartika S 1	Kartika 24 / Agrahn.1 / Nov 15
Annakuta	Kartika S 1	Kartika 24 / Agrahn.1 / Nov 15
53. Kartika Sukladi	Kartika S 1	Kartika 25/ Agrahn.2 /Nov 16
54. Bhratri Dvitiya, Dwat Puja, Tikka	Kartika S 2 (Aparhna)	Kartika 25/ Agrahn.2 /Nov 16
Ceremony, Bhai Duj		Kartika 25/ Agrahn.2 /Nov 16
Bhratri Dvitiya (Bengal)	Kartika S 2 (Madhyahna)	Kartika 25/ Agrahn.2 /Nov 16
55. Pratihar Shasthi or Surya Shashthi, Chhat-Bihar	Kartika S 6	Kartika 29 / Agrahn.6 / Nov 20
56. Goshtashtami or Gopashtami	Kartika S 8	Agrahayana 1 / Agrahn. 8 / Nov22
57. Guru Teg Bahadur's Martyrdom Day	Fixed	Agrahayana 3/Agrahn. 10 / Nov 24
58. Rasayatra (Smarta)	Kartika S 15 (Nisithavyapini)	Agrahayana 8/Agrahn. 15 / Nov 29
59. Rasayatra (Vaishnava)	Kartika S 15 (Udayavyapini)	Agrahayana 9/Agrahn. 16 / Nov 30
60. Guru Nanak's Birthday	Kartika S 15 (Udayavyapini)	Agrahayana 9/Agrahn. 16 / Nov 30
Ratha Yatra (Jain),	Kartika S 15 (Udayavyapini)	Agrahayana 9/Agrahn. 16 / Nov 30
Kartiki Purnima,	Kartika S 15	Agrahayana 9/Agrahn. 16 / Nov 30
Pushkar Fair	Kartika S 15	Agrahayana 9/Agrahn. 16 / Nov 30
Huthri –(3 days.) Coorg	S 15 to K 2 of Saura Margasirsa	Agrahayana 9/Agrahn. 16 / Nov 30
61. Prathamashtami (Odisha)	Kartika K 8	Agrahayana 17/Agrahn. 24 / Dec 8
62. Vaikuntha Ekadasi (S.India)	S 11 of Saura Pausha	Pausha 4 / Pausha 11 / Dec 25
63. Jor Mela-3 days- (Punjab)	Fixed	Pausha 5 / Pausha 12 / Dec 26
		Saka 1942/Kali 5121 /2021 A.D.
64. Bhogi (S. India)	Day before Pongal	Pausha 23 / Pausha 30 / Jan 13
65. Makara Samkranti (Bengal)	Saura Maghadi (Midnight Rule)	Pausha 24 / Magha 1 / Jan.14
Magha Bihu (Assam)	Saura Maghadi (Midnight Rule)	Pausha 24 / Magha 1 / Jan.14
66. Pongal (S.India),Tai Pongal(Kerala)	The day of Saura Maghadi	Pausha 24 / Magha 1 / Jan.14
Tamil New Year's day ,Tila Samkranti,	The day of Saura Maghadi	Pausha 24 / Magha 1 / Jan.14
Makara Samkranti (N. India)	The day of Saura Maghadi	Pausha 24 / Magha 1 / Jan.14
Makaradi snana	The day of Saura Maghadi	Pausha 24 / Magha 1 / Jan.14
67. Mattu Pongal or Kanuvu	Day after Pongal	Pausha 25 / Magha 2 / Jan.15
68. Guru Gobind Singh's Birth Day	Pausha S 7	Pausha 30 / Magha 7 / Jan.20
69. Netaji's Birthday	Fixed	Magha 3/ Magha 10/ Jan.23
70. Republic Day	Fixed	Magha 6/ Magha 13/ Jan.26
71. Sri Panchami, Vasanta Panchami	Magha S 5	Magha 27 / Phalguna 4 / Feb 16
72. Sivaji Jayanti	Fixed	Magha 30 / Phalguna 7 / Feb 19
73. Guru Ravidas's Birthday	Magha S 15	Phalguna 8 / Phalguna 15 / Feb 27
74. Birth Day of Swami Dayananda Saraswati (Founder of Arya Samaj")	Phalguna K 10 (Purnimanta)	Phalguna 17/ Phalguna 24 / Mar 8
75. Maha Sivaratri (Kashmir)	Magha K 13	Phalguna 19/ Phalguna 26/March 10
76. Maha Sivaratri, Maha Sivaratri (S.India)	Magha K 14 (Prodosa &	Phalguna 20 /Phalguna 27/March 11
	Nishithavyapini)	Phalguna 20 /Phalguna 27/March 11
77. MahaVishuva day	Day of Sun's entry into Trop. Aries (Midnight rule)	Phalguna 29 / Chaitra 6 / March 20
		Saka 1943/Kali 5121 /2021 A.D.
78. Indian New Year's Day	Fixed	Chaitra 1/ Chaitra 8 / March 22
79. Holikadahan, Dolyatra	Phalguna S 15 (night)	Chaitra 7/ Chaitra 14 / March 28
80. Holi, Hola, Vasantotsava	Day after Holikadahana, Phalguna K 1	Chaitra 8/ Chaitra 15 / March 29
Special Festivals for Jammu and Kashmir		
		National / Nirayana / Gregorian
		Saka 1941/ Kali 5120/ 2020 A.D.
7. Lohri	Day before Saura Maghadi (Sunrise Rule)	Pausha 23/ Pausha 30/ Jan. 13
		Saka 1942/ Kali 5120/ 2020 A.D.
1. Mela Bahu Fort	Chaitra S 8	Chaitra 12 / Chaitra 18 / April 1
		Saka 1942 / Kali 5121 / 2020 A.D
2. Mela Kshir Bhawani (2 days)	Jyaishtha S 8	Jyaishtha 9 / Jyaishtha 16/May 30
3. Guru Hargobind's Birthday	Jyaishtha K 1	Jyaishtha 16 / Jyaishtha 23 / June 6
4. Martyr's Day	Fixed	Asadha 22 / Asadha 29 / July 13
5. Kailas Yatra	Sravana K 13, K 14	Sravana 26 / Bhadra 2 / Aug 17
6. Mela Pat	Bhadra S 5 to S 7	Bhadra 1 / Bhadra 8 / Aug 23
		Saka 1942/ Kali 5121 / 2021 A.D.
7. Lohri	Day before Saura Maghadi (Sunrise Rule)	Pausha 23 / Pausha 30 / Jan. 13

MOSLEM FESTIVALS, 2020-2021 A.D.

Festivals	Criterion	Date
		National / Nirayana / Gregorian
		Saka 1942 / Kali 5120 / 2020 A.D
1. Sab-e-Miraj *	27 Rajab	Chaitra 3 / Chaitra 9 / Mar 23
2. Sab-e-Barat*	15 Shaban	Chaitra 20 / Chaitra 26 / April 9
		Saka 1942 / Kali 5121 / 2020 A.D
3. First day of Ramadan	1 Ramadan	Chaitra 24 / Vaisakha 1 / April 14
4. Shahadat-e-Hazrat Ali	21 Ramadan	Vaisakha 25 / Jyaishtha 1 / May 15
5. Sab -e- Qadr *.	27 Ramadan	Vaisakha 31 / Jyaishtha 7/ May 21
6. Jumat Ul Vida	Last Friday of Ramadan	Jyaishtha 1 / Jyaishtha 8/ May 22
7. Id-ul -Fitr	1 Shawwal	Jyaishtha 4 / Jyaishtha 11/ May 25
8. Id-uz -Zuha (Bakrid)	10 Zulhijja	Sravana 10 / Sravana 17 / Aug. 1
9. Muharram	10 Muharram	Bhadra 8 /Bhadra 15 / Aug. 30
10. Chelhum	Fortieth day from (39 days after) 10 Muharram	Asvina 16 / Asvina 23 / Oct 8
11. Akheri Chahar Shumba	Last Wednesday of Safar	Asvina 22 / Asvina 29 / Oct 14
12. Shahadat -e- Iman Hasan	28 Safar	Asvina 24 / Kartika 1 / Oct. 16
13. Milad-un Nabi or Id-e-Milad(Birth Day of the Prophet), Fateha Dwaz Daham or Bara Wafat	12 Rabiu'l awwal	Kartika 8 / Kartika 15 / Oct.30
14. Id-e-Maulad	17 Rabiu'l awwal	Kartika 13 / Kartika 20 /Nov. 4
15. Fateha Yazdadham (Giarhween Sharif)	11 Rabius Sani	Agrah. 6/ Agrahayana 13 / Nov. 27
		Saka 1942 / Kali 5121 / 2021 A.D
16. Hazrat ali's Birthday	13 Rajab	Phalguna 7 / Phalguna 14 /Feb 26
17. Sab-e-Miraj *	27 Rajab	Phalguna 21 / Phalguna 28 /Mar 12
		Saka 1943 / Kali 5121 / 2021 A.D
1. Sab-e-Barat *	15 Shaban	Chaitra 9 / Chaitra 16 / Mar 30
		Saka 1943 / Kali 5122 / 2021 A.D
2. First day of Ramadan	1 Ramadan	Chaitra 24 / Vaisakha 1 / April 14

* The festival is observed in the preceding night

THE ISLAMIC CALENDAR 2020-2021 A.D. (Hejira : 1441-1442 A. H.)

The beginning dates of the different months of the Islamic Calendar for the year 2020-2021 A.D. determined on the basis of the first visibility of the lunar crescent after the New-Moon day culculated for the Central Station of India are as follows:-

Jumadu's sani	1441 A.H.	Jan. 27	2020	(30)	Safar	1441 A.H.	Sept. 19	2020	(30)
Rajab	"	Feb. 26	"	(29)	Rabiu'l awwal	"	Oct. 19	"	(29)
Shaban	"	Mar. 26	"	(30)	Rabiu's sani	"	Nov. 17	"	(30)
Ramadan	"	Apr. 25	"	(30)	Jumadu'l awwal	"	Dec. 17	"	(29)
Shawwal	"	May 25	"	(29)	Jumadu's sani	"	Jan. 15	2021	(30)
Zu'lqada	"	June 23	"	(30)	Rajab	"	Feb. 14	"	(30)
Zulhijja	"	July 23	"	(29)	Shaban	"	Mar. 16	"	(29)
MUHARRAM	1442 A.H.	Aug. 21	"	(29)	Ramadan	"	April 14	"	(30)

N.B.-Actually the months begin from sunset of the preceding day when the Moon becomes first visible.

Fixed Calendar

According to the Fixed Calendar the beginning dates of different months are as follows : 2020 - Jan. 27, Feb. 25, Mar. 26, Apr. 24, May 24, June 22, July 22, Aug. 20, Sept. 19, Oct. 18, Nov. 17, Dec. 16 2021 - Jan. 15, Feb. 13, Mar. 15, Apr. 12.

THE PARSI (SHAHENSHAHI) CALENDAR, 2020 - 2021 A.D.

(As used by the Indian Parsis)

Yazdejardi Era : 1389 - 1390

The beginning dates of different months of the Parsi Shahenshahi Calendar are as follows :
As regards the Parsi Kadmi Calendar, the months are the same but they begin 30 days earlier.

Shahrivar	**1389**	Jan. 14	2020	(30)	Ardibehesht	**1390**	Sept. 15	2020	(30)
Meher	"	Feb. 13	"	(30)	Khordad	"	Oct. 15	"	(30)
Avan	"	Mar. 14	"	(30)	Tir	"	Nov. 14	"	(30)
Adar	"	Apr. 13	"	(30)	Amardad	"	Dec. 14	"	(30)
Dei	"	May 13	"	(30)	Shahrivar	"	Jan. 13	2021	(30)
Bahman	"	June 12	"	(30)	Meher	"	Feb. 12	"	(30)
Aspandad	"	July 12	"	(30)	Avan	"	Mar. 14	"	(30)
Gathas(I-V)	"	Aug. 11	"	(5)	Adar	"	Apr. 13	"	(30)
FARVARDIN	**1390**	Aug. 16	"	(30)	Dei	"	May 13	"	(30)

PARSI FESTIVALS 2020-2021 A.D.

Festivals	Criterion	Shahenshahi	Kadmi
		National / Nirayana / Gregorian **Saka 1942/ Kali 5121/ 2020 A.D.**	**National / Nirayana / Gregorian** **Saka 1942/ Kali 5121/ 2020 A.D.**
Zarthost-no-Diso	11 Dei	Jyaishtha 2/ Jyaishtha 9/ May 23	Vaisakha 3/ Vaisakha 10/ Apr. 23
Gatha Gahambar	Gatha III	Sravana 22/ Sravana 29/ Aug. 13	Ashadha 23/ Ashadha 30/ July 14
Parsi New Year Eve	Gatha V	Sravana 24/ Sravana 31/ Aug. 15	Ashadha 25/ Sravana 1/ July 16
Parsi New Year's Day	1 Farvardin	Sravana 25/ Bhadra 1/ Aug. 16	Ashadha 26/ Sravana 2/ July 17
Khordad Sal (Birthday of Prophet Zarthost)	6 Farvardin	Shravana 30/ Bhadra 6/ Aug. 21	Ashadha 31/ Sravana 7/ July 22

N.B.- Jamshedi Naoroj falls on March 21 every year

THE JEWISH CALENDAR, 2020 - 2021 A.D.

Jewish Era : 5780 - 81 A.M.

To beginning dates of different months of the Jewish Calendar are as follows:

Shebat	**5780**	Jan. 27	2020	(30)	TISHRI	**5781**	Sept. 19	2020	(30)
Adar	"	Feb. 26	"	(29)	Heshvan	"	Oct. 19	"	(29)
Nisan	"	Mar. 26	"	(30)	Kislev	"	Nov. 17	"	(29)
Iyar	"	Apr. 25	"	(29)	Tebeth	"	Dec. 16	"	(29)
Sivan	"	May 24	"	(30)	Shebat	"	Jan. 14	2021	(30)
Tammuz	"	June 23	"	(29)	Adar		Feb. 13	"	(29)
Ab	"	July 22	"	(30)	Nisan	"	Mar. 14	"	(30)
Ellul	"	Aug. 21	"	(29)	Iyar	"	Apr. 13	"	(29)

JEWISH FESTIVALS 2020-2021 A.D.

Festivals	Criterion	Date
		National / Nirayana / Gregorian
		Saka 1942/Kali 5120 / 2020 A.D.
First day of Passover (Pesach)	15 Nisan	Chaitra 20 / Chaitra 26 / April 9
		Saka 1942/Kali 5121 / 2020 A.D.
Feast of Weeks (Shebuoth)	6 Sivan	Jyaishtha 8 / Jyaishtha 15 / May 29
Tishabeab	9 Ab	Sravana 8 / Sravana 15 / July 30
Jewish New Year (Rosh Hashanah)	1 Tishri	Bhadra 28/ Asvina 4 / Sept 19
Day of Atonement (Yom Kippur)	10 Tishri	Asvina 6 / Asvina 13 /Sept 28
First day of Tabernacles (Succoth)	15 Tishri	Asvina 11/ Asvina 18 / Oct 3
Last day of Succoth (SimhathTorah)	23 Tishri	Asvina 19 / Asvina 26 /October 11
Hanukah	25 Kislev	Arghayana 20 /Argh. 27 / Dec 11
		Saka 1942/Kali 5121 / 2021 A.D.
Purim	14 Adar	Phalguna 7/ Phalguna 14 / Feb 26
		Saka 1943/Kali 5121 / 2021 A.D.
First day of Passover (Pesach)	15 Nisan	Chaitra 7/ Chaitra 14 / March 28

CHRISTIAN FESTIVALS, 2020-2021 A.D.

Festivals	Criterion	Date
		National / Nirayana / Gregorian
		Saka 1941 / Kali 5120/ 2020 A.D.
1. Christian (English) New Year's Day	Fixed	Pausha 11 / Pausha 18 / Jan. 01
2. Epiphany	Fixed	Pausha 16 / Pausha 23 / Jan. 06
3. Septuagesima Sunday	63 days before Easter Sunday	Magha 20 / Magha 27 / Feb 09
4. Quinquagesima (Shrove) Sunday	49 days before Easter Sunday	Phalguna 04/Phalguna 11 /Feb 23
5. Ash Wednesday	46 days before Easter Sunday	Phalguna 07 /Phalguna 14/Feb 26
		Saka 1942/ Kali 5120 / 2020 A.D.
6. Palm Sunday	7 days before Easter Sunday	Chaitra 16/Chaitra 22 / April 05
7. Good Friday	2 days before Easter Sunday	Chaitra 21/ Chaitra 27/ April 10
8. Easter (Holy) Saturday	Day before Easter Sunday	Chaitra 22/ Chaitra 28/ April 11
9. Easter Sunday	First Sunday after the 14th day of the Moon (nearly Full Moon) occurring on or immediately after March 21	Chaitra 23/ Chaitra 29/ April 12
		Saka 1942/ Kali 5121 / 2020 A.D.
10. Low Sunday	7 days after Easter Sunday	Chaitra 30/Vaisakha 6/April 19
11. Rogation Sunday	35 days after Easter Sunday	Vaisakha 27/Jyaishtha 3 / May 17
12. Ascension Day-Holy Thursday	39 days after Easter Sunday	Vaisakha 31 /Jyaishtha 7 / May 21
13. Ascension Sunday	3 days after Ascension day	Jyaishtha 3/Jyaishtha 10/ May 24
14. Whit Sunday-Pentecost	49 days after Easter Sunday	Jyaishtha 10/Jyaishtha 17 /May 31
15. Trinity Sunday	56 days after Easter Sunday	Jyaishtha 17 / Jyaishtha 24/June 7
16. Corpus Christi (Thursday)	60 days after Easter Sunday	Jyaishtha 21/ Jyaishtha 28/June 11
17. First Sunday in Advent	Fourth Sunday before Christmas, i.e.,Sunday nearest to Nov.30.	Agrahn. 8 / Agrahn. 15 / Nov 29
18. Christmas Eve	Day before Christmas	Pausha 03 / Pausha 10 / Dec. 24
19. Christmas Day	Fixed	Pausha 04 / Pausha 11 / Dec. 25
20. New Year Eve	Fixed	Pausha 10 / Pausha 17 / Dec. 31
		Saka 1942/ Kali 5121 / 2021 A.D.
1. Christian (English) New Year's Day	Fixed	Pausha 11 / Pausha 18 / Jan 01
2 Epiphany	Fixed	Pausha 16 / Pausha 23 / Jan 06
3. Septuagesima Sunday	63 days before Easter Sunday	Magha 11 / Magha 18 / Jan 31
4. Quinquagesima (Shrove) Sunday	49 days before Easter Sunday	Magh 25/ Phalguna 2 / Feb 14
5. Ash Wednesday	46 days before Easter Sunday	Magh 28/ Phalguna 5 / Feb 17
		Saka 1943 / Kali 5121/ 2021 A.D.
6. Palm Sunday	7 days before Easter Sunday	Chaitra 7/ Chaitra 14 / March 28
7. Good Friday	2 days before Easter Sunday	Chaitra 12/ Chaitra 19 / April 2
8. Easter (Holy) Saturday	Day before Easter Sunday	Chaitra 13/ Chaitra 20 / April 3
9. Easter Sunday	First Sunday after the 14th day of the Moon (nearly Full Moon) occurring on or immediately after March 21	Chaitra 14 /Chaitra 21 /April 4
10. Low Sunday	7 days after Easter Sunday	Chaitra 21/ Chaitra 28 /April 11

THE INDIAN LUNAR CALENDAR

TIME OF NEW MOON (IN I.S.T.) MARKING THE COMMENCEMENT OF LUNAR MONTHS

2003 (1924 - 25 S.E.)

		d	h	m
Pausha	Jan.	2	25	53
Magha	Feb.	1	16	19
Phalguna	Mar.	3	08	05
Chaitra	Apr.	1	24	48
Vaisakha	May	1	17	44
Jyaishtha	May	31	09	49
Ashadha	June	29	24	07
Sravana	July	29	12	21
Bhadra	Aug.	27	22	54
Asvina	Sept	26	08	37
Kartika	Oct.	25	18	19
Margasirsha	Nov.	23	28	28
Pausha	Dec.	23	15	13

2004 (1925 - 26 S.E.)

		d	h	m
Pausha			---	
Magha	Jan.	21	26	35
Phalguna	Feb.	20	14	48
Chaitra	Mar.	20	28	11
Vaisakha	Apr.	19	18	51
Jyaishtha	May	19	10	22
Ashadha	June	17	29	57
Sravana	*July*	*17*	*16*	*54*
	Aug.	16	06	54
Bhadra	Sept.	14	19	59
Asvina	Oct.	14	08	18
Kartika	Nov.	12	19	57
Margasirsha	Dec	12	06	59
Pausha			---	

2005 (1926 - 27 S.E.)

		d	h	m
Pausha	Jan.	10	17	33
Magha	Feb.	8	27	58
Phalguna	Mar.	10	14	40
Chaitra	Apr.	8	26	02
Vaisakha	May	8	14	15
Jyaishtha	June	6	27	25
Ashadha	July	6	17	33
Sravana	Aug.	5	08	35
Bhadra	Sept	3	24	15
Asvina	Oct.	3	15	58
Kartika	Nov.	2	06	55
Margasirsha	Dec.	1	20	31
Pausha	Dec.	31	08	42

2006 (1927 - 28 S.E.)

	d	h	m
		—	
Jan.	29	19	45
Feb.	27	30	01
Mar.	29	15	45
Apr.	27	25	14
May	27	10	56
June	25	21	35
July	25	10	01
Aug.	23	24	40
Sept.	22	17	15
Oct.	22	10	44
Nov.	20	27	48
Dec.	20	19	31

2007 (1928 - 29 S.E.)

	d	h	m
		—	
Jan.	19	09	31
Feb.	17	21	44
Mar.	19	08	13
Apr.	17	17	06
May	*16*	*24*	*57*
June	15	08	43
July	14	17	34
Aug.	12	28	33
Sept.	11	18	14
Oct.	11	10	31
Nov.	9	28	33
Dec.	9	23	10

2008 (1929 - 30 S.E.)

	d	h	m
Jan.	8	17	17
Feb.	7	09	14
Mar.	7	22	44
Apr.	6	09	25
May	5	17	48
June	3	24	53
July	3	07	49
Aug.	1	15	43
Aug.	30	25	28
Sept.	29	13	42
Oct.	28	28	44
Nov.	27	22	25
Dec.	27	17	52

2009 (1930 - 31 S.E.)

	d	h	m
		—	
Jan.	26	13	25
Feb.	25	07	05
Mar.	26	21	36
Apr.	25	08	53
May	24	17	41
June	22	25	05
July	22	08	05
Aug.	20	15	32
Sept.	18	24	14
Oct.	18	11	03
Nov.	16	24	44
Dec.	17	17	32

2010 (1931 - 32 S.E.)

	d	h	m

Jan.	15	12	41
Feb.	14	08	21
Mar.	15	26	31
Apr.	*14*	*17*	*59*
May	14	06	34
June	12	16	45
July	11	25	10
Aug.	10	08	38
Sept.	8	16	00
Oct.	7	24	15
Nov.	6	10	22
Dec.	5	23	06

2011 (1932 - 33 S.E.)

	d	h	m
Jan.	4	14	33
Feb.	3	08	01
Mar.	4	26	16
Apr.	3	20	02
May	3	12	21
June	1	26	33
July	1	14	24
July	30	24	10
Aug.	29	08	34
Sept.	27	16	39
Oct.	26	25	26
Nov.	25	11	40
Dec.	24	23	36

N.B.- The figures in the italics show the beginning of the intercalary (*mala or adhika*) month followed by the normal (*suddha or nija*) month of the same name.

THE INDIAN LUNAR CALENDAR

TIME OF NEW MOON (IN I.S.T.) MARKING THE
COMMENCEMENT OF LUNAR MONTHS

	2012 (1933 - 34 S.E.)				2015 (1936 - 37 S.E.)				2018 (1939 - 40 S.E)				2021 (1942 - 43 S.E)			
		d	h	m		d	h	m		d	h	m		d	h	m
			---				---				---					
Pausha	Jan.	23	13	09	Jan.	20	18	44	Jan.	17	07	47	Jan.	13	10	30
Magha	Feb.	21	28	05	Feb.	18	29	17	Feb.	15	26	35	Feb.	11	24	36
Phalguna	Mar.	22	20	07	Mar.	20	15	06	Mar.	17	18	42	Mar.	13	15	51
Chaitra	Apr.	21	12	48	Apr.	18	24	27	Apr.	16	07	27	Apr.	12	08	01
Vaisakha													May	11	24	30
Jyaishtha	May	20	05	17	May	18	09	43	*May*	*15*	*17*	*18*	June	10	16	23
									June	13	25	13				
Ashadha	June	19	20	32	*June*	*16*	*19*	*35*	July	13	08	18	July	10	06	47
					July	16	06	54								
Sravana	July	19	09	54	Aug.	14	20	23	Aug.	11	15	28	Aug.	08	19	20
Bhadra	*Aug.*	*17*	*21*	*24*	Sept	13	12	11	Sept.	09	23	32	Sept.	07	06	22
	Sept.	16	07	41												
Asvina	Oct.	15	17	33	Oct.	12	29	36	Oct.	09	09	17	Oct.	06	16	35
Kartika	Nov.	13	27	38	Nov.	11	23	17	Nov.	07	21	32	Nov.	04	26	45
Margasirsha	Dec.	13	14	12	Dec.	11	15	59	Dec.	07	12	50	Dec.	04	13	13
Pausha			---				---				---				---	

	2013 (1934 - 35 S.E.)				2016 (1937 - 38 S.E.)				2019 (1940 - 41 S.E.)				2022 (1943 - 44 S.E)			
Pausha	Jan.	11	25	14	Jan.	10	07	01	Jan.	6	06	58	Jan.	2	24	04
Magha	Feb.	10	12	50	Feb.	8	20	09	Feb.	4	26	34	Feb.	1	11	16
Phalguna	Mar.	11	25	21	Mar.	9	07	25	Mar.	6	21	34	Mar.	2	23	05
Chaitra	Apr.	10	15	05	Apr.	7	16	54	Apr.	5	14	21	Apr.	1	11	54
Vaisakha	May	10	05	58	May	6	25	00	May	4	28	16	Apr.	30	25	58
Jyaishtha	June	8	21	26	June	5	08	30	June	3	15	32	May	30	17	00
Ashadha	July	8	12	44	July	4	16	31	July	2	24	46	June	29	08	22
Sravana	Aug.	6	27	21	Aug.	2	26	15	Aug.	1	08	42	July	28	23	25
Bhadra	Sept.	5	17	06	Sept.	1	14	33	Aug.	30	16	07	Aug.	27	13	47
Asvina	Oct.	5	06	05	Sept.	30	29	41	Sept.	28	23	56	Sept.	25	27	25
Kartika	Nov.	3	18	20	Oct.	30	23	08	Oct.	28	09	09	Oct.	25	16	19
Margasirsha	Dec.	2	29	52	Nov.	29	17	48	Nov.	26	20	36	Nov.	23	28	27
Pausha			---		Dec.	29	12	23	Dec.	26	10	43	Dec.	23	15	47

	2014 (1935 - 36 S.E.)				2017 (1938 - 39 S.E.)				2020 (1941 - 42 S.E.)			
Pausha	Jan.	1	16	44			---				---	
Magha	Jan..	30	27	09	Jan.	27	29	37	Jan.	24	27	12
Phalguna	Mar.	1	13	30	Feb.	26	20	28	Feb.	23	21	02
Chaitra	Mar.	30	24	15	Mar.	28	08	27	Mar.	24	14	58
Vaisakha	Apr.	29	11	44	Apr.	26	17	46	Apr.	23	07	56
Jyaishtha	May	28	24	10	May	25	25	14	May	22	23	09
Ashadha	June	27	13	39	June	24	08	01	June	21	12	11
Sravana	July	26	28	12	July	23	15	16	July	20	23	03
Bhadra	Aug.	25	19	43	Aug.	21	24	00	Aug.	19	08	12
Asvina	Sept.	24	11	44	Sept.	20	11	00	*Sept.*	*17*	*16*	*30*
									Oct.	16	25	01
Kartika	Oct.	23	27	27	Oct.	19	24	42	Nov.	15	10	37
Margasirsha	Nov.	22	18	02	Nov.	18	17	12	Dec.	14	21	47
Pausha	Dec.	22	07	06	Dec.	18	12	00			---	

N.B.- The figures in the italics show the beginning of the intercalary (*mala or adhika*) month followed by the normal (*suddha or nija*) month of the same name.

INDIAN CALENDAR

SAKA ERA 1943 — Mesha : Madhava

Month of CHAITRA (30 days) — Spring (Vasanta), 2nd Month

(*Nirayana*) 8 Chaitra, 5121 Kali Era to (*Nirayana*) 7 Vaisakha, 5122 Kali Era

Date	Week Day	Gregorian Date		Sunrise		Apparent Noon		Sunset		Tithi				Nakshatra			Yoga		
										No.		Ending Moment		No.	Ending Moment		No.	Ending Moment	
				h	m	h	m	h	m			h	m		h	m		h	m
		2021 A.D.																	
1	Mon	Mar.	22	6	02.2	12	06.9	18	11.7	S	8	9	00.7	6	21	27.7	4	12	55.0
2	Tue		23	6	01.2	12	06.6	18	12.1		9	10	07.6	7	22	45.2	5	12	37.4
3	Wed		24	6	00.3	12	06.3	18	12.5	S	10	10	23.9	8	23	12.2	6	11	40.5
4	Thu		25	5	59.3	12	06.0	18	12.8		11	9	47.7	9	22	48.7	7	10	02.6
5	Fri		26	5	58.3	12	05.7	18	13.2		12	8	21.6	10	21	39.2	8	7	45.2
																	(9	28	52.5)
6	Sat		27	5	57.3	12	05.4	18	13.6		13	6	12.0	11	19	51.6	10	25	31.1
											(14	27	27.4)						
7	Sun		28	5	56.4	12	05.1	18	14.0	S	15	24	18.1	12	17	35.6	11	21	48.5
8	Mon		29	5	55.4	12	04.8	18	14.3	K	1	20	54.8	13	15	02.0	12	17	53.4
9	Tue		30	5	54.4	12	04.5	18	14.7		2	17	27.7	14	12	21.7	13	13	53.9
10	Wed		31	5	53.5	12	04.2	18	15.1		3	14	06.6	15	9	45.2	14	9	58.2
11	Thu	Apr.	1	5	52.5	12	03.9	18	15.4		4	11	00.3	16	7	21.7	15	6	13.4
														(17	29	19.2)	(16	26	45.6)
12	Fri		2	5	51.5	12	03.6	18	15.8	K	5	8	15.9	18	27	43.6	17	23	39.4
13	Sat		3	5	50.6	12	03.3	18	16.2		6	5	59.0	19	26	38.5	18	20	57.8
											(7	28	13.2)						
14	Sun		4	5	49.6	12	03.0	18	16.5		8	27	00.0	20	26	05.6	19	18	42.3
15	Mon		5	5	48.7	12	02.7	18	16.9		9	26	19.3	21	26	04.8	20	16	53.0
16	Tue		6	5	47.7	12	02.4	18	17.3	K	10	26	09.7	22	26	34.6	21	15	29.0
17	Wed		7	5	46.8	12	02.1	18	17.7		11	26	29.4	23	27	32.9	22	14	28.7
18	Thu		8	5	45.8	12	01.8	18	18.1		12	27	16.2	24	28	57.4	23	13	50.4
19	Fri		9	5	44.9	12	01.6	18	18.4		13	28	28.2	25	-	-	24	13	32.5
20	Sat		10	5	44.0	12	01.3	18	18.8		14	-	-	25	6	46.1	25	13	33.5
21	Sun		11	5	43.1	12	01.0	18	19.2		14	6	03.7	26	8	57.5	26	13	52.1
22	Mon		12	5	42.2	12	00.8	18	19.6	K	30	8	00.8	27	11	29.4	27	14	26.7
23	Tue		13	5	41.3	12	00.5	18	20.0	S	1	10	17.1	1	14	19.3	1	15	15.2
24	Wed		14	5	40.4	12	00.3	18	20.4		2	12	48.2	2	17	22.5	2	16	14.3
25	Thu		15	5	39.5	12	00.0	18	20.8		3	15	27.5	3	20	32.5	3	17	18.9
26	Fri		16	5	38.6	11	59.8	18	21.2		4	18	06.2	4	23	39.9	4	18	22.7
27	Sat		17	5	37.8	11	59.6	18	21.6	S	5	20	32.9	5	26	33.5	5	19	17.5
28	Sun		18	5	36.9	11	59.4	18	22.0		6	22	35.3	6	29	01.5	6	19	54.5
29	Mon		19	5	36.1	11	59.1	18	22.4		7	24	02.0	7	-	-	7	20	05.4
30	Tue		20	5	35.3	11	58.9	18	22.8	S	8	24	43.8	7	6	52.6	8	19	42.7

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

AYANAMSA, 2020-2021

TRUE AYANAMSA FOR $5^h\ 29^m.0$ I.S.T.

Date 2020	Ayanamsa °	′	″	Date 2020	Ayanamsa °	′	″	Date 2020	Ayanamsa °	′	″	Date 2020-21	Ayanamsa °	′	″
Jan. 1	24	07	54.8	Apr. 30	24	08	09.5	Aug. 28	24	08	28.1	Dec. 26	24	08	44.0
4	24	07	55.0	May 3	24	08	10.0	31	24	08	28.7	29	24	08	44.7
7	24	07	55.5	6	24	08	10.1	Sept. 3	24	08	28.8	Jan. 1	24	08	45.5
10	24	07	56.3	9	24	08	10.5	6	24	08	28.8	4	24	08	46.1
13	24	07	57.0	12	24	08	11.3	9	24	08	29.0	7	24	08	46.3
16	24	07	57.3	15	24	08	11.8	12	24	08	29.6	10	24	08	46.8
19	24	07	57.6	18	24	08	12.0	15	24	08	30.1	13	24	08	47.8
22	24	07	58.3	21	24	08	12.2	18	24	08	30.2	16	24	08	48.4
25	24	07	59.0	24	24	08	12.8	21	24	08	30.2	19	24	08	48.6
28	24	07	59.4	27	24	08	13.6	24	24	08	30.8	22	24	08	48.9
31	24	07	59.5	30	24	08	14.1	27	24	08	31.3	25	24	08	49.4
Feb. 3	24	07	59.8	June 2	24	08	14.3	30	24	08	31.5	28	24	08	50.2
6	24	08	00.4	5	24	08	14.8	Oct. 3	24	08	31.5	31	24	08	50.7
9	24	08	01.1	8	24	08	15.7	6	24	08	31.6	Feb. 3	24	08	50.8
12	24	08	01.3	11	24	08	16.3	9	24	08	32.1	6	24	08	51.2
15	24	08	01.5	14	24	08	16.6	12	24	08	32.7	9	24	08	07.1
18	24	08	02.0	17	24	08	16.9	15	24	08	32.9	12	24	08	07.5
21	24	08	02.6	20	24	08	17.4	18	24	08	32.9	15	24	08	07.9
24	24	08	02.9	23	24	08	18.3	21	24	08	33.5	18	24	08	08.3
27	24	08	02.9	26	24	08	18.9	24	24	08	34.2	21	24	08	08.7
Mar. 1	24	08	03.0	29	24	08	19.1	27	24	08	34.4	24	24	08	09.1
4	24	08	03.5	July 2	24	08	19.6	30	24	08	34.5	27	24	08	09.5
7	24	08	04.1	5	24	08	20.4	Nov. 2	24	08	34.7	Mar. 2	24	08	09.9
10	24	08	04.3	8	24	08	21.1	5	24	08	35.3	5	24	08	10.4
13	24	08	04.3	11	24	08	21.4	8	24	08	36.0	8	24	08	10.8
16	24	08	04.7	14	24	08	21.6	11	24	08	36.3	11	24	08	11.2
19	24	08	05.3	17	24	08	22.1	14	24	08	36.5	14	24	08	11.6
22	24	08	05.5	20	24	08	22.9	17	24	08	37.1	17	24	08	12.0
25	24	08	05.5	23	24	08	23.5	20	24	08	38.0	20	24	08	12.4
28	24	08	05.6	26	24	08	23.7	23	24	08	38.4	23	24	08	12.8
31	24	08	06.0	29	24	08	24.0	26	24	08	38.6	26	24	08	13.2
Apr. 3	24	08	06.5	Aug. 1	24	08	24.7	29	24	08	39.0	29	24	08	13.7
6	24	08	06.8	4	24	08	25.4	Dec. 2	24	08	39.6	Apr. 1	24	08	14.1
9	24	08	06.8	7	24	08	25.6	5	24	08	40.4	4	24	08	14.5
12	24	08	07.3	10	24	08	25.7	8	24	08	40.9	7	24	08	14.9
15	24	08	07.9	13	24	08	26.0	11	24	08	41.2	10	24	08	15.3
18	24	08	08.2	16	24	08	26.7	14	24	08	41.8	13	24	08	15.7
21	24	08	08.3	19	24	08	27.2	17	24	08	42.8	16	24	08	16.1
24	24	08	08.4	22	24	08	27.4	20	24	08	43.4	19	24	08	16.6
27	24	08	08.9	25	24	08	27.5	23	24	08	43.7	22	24	08	17.0
Apr. 30	24	08	09.5	Aug. 28	24	08	28.1	Dec. 26	24	08	44.0	Apr. 25	24	08	17.4

Mean Ayanamsa = $23^0 + 51' + 25''.53$ + precession in longitude from 2000.0 to date

= $24^0 + 08' + 11''.46$ + precession in longitude from 2020.0 to date

= $24^0 + 09' + 01''.72$ + precession in longitude from 2021.0 to date

True Ayanamsa = Mean Ayanamsa + Nutation in longitude

LONGITUDE OF SUN, MOON AND PLANETS, 2021

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 29^m.0$ I.S.T.

Date		Sun			Moon			Mercury			Venus			Mars			Jupiter			Saturn		
		°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
Jan.	0	279	45	36	109	46	19	286	05	16	259	09	29	26	55	41	302	33	18	301	30	40
	1	280	46	44	122	43	29	287	42	50	260	24	37	27	21	27	302	46	58	301	37	29
	2	281	47	53	135	54	26	289	20	37	261	39	45	27	47	29	303	00	41	301	44	19
	3	282	49	01	149	18	24	290	58	37	262	54	54	28	13	49	303	14	25	301	51	12
	4	283	50	10	162	54	25	292	36	49	264	10	04	28	40	24	303	28	12	301	58	05
	5	284	51	19	176	41	25	294	15	11	265	25	14	29	07	16	303	42	01	302	05	01
	6	285	52	28	190	38	20	295	53	39	266	40	25	29	34	23	303	55	53	302	11	57
	7	286	53	37	204	44	03	297	32	11	267	55	36	30	01	45	304	09	46	302	18	55
	8	287	54	47	218	57	08	299	10	43	269	10	48	30	29	22	304	23	41	302	25	54
	9	288	55	57	233	15	39	300	49	09	270	25	60	30	57	14	304	37	38	302	32	54
	10	289	57	07	247	36	55	302	27	23	271	41	13	31	25	20	304	51	37	302	39	55
	11	290	58	16	261	57	22	304	05	18	272	56	26	31	53	41	305	05	37	302	46	58
	12	291	59	26	276	12	41	305	42	44	274	11	39	32	22	14	305	19	40	302	54	01
	13	293	00	36	290	18	09	307	19	31	275	26	52	32	51	02	305	33	43	303	01	06
	14	294	01	45	304	09	17	308	55	26	276	42	06	33	20	02	305	47	48	303	08	11
	15	295	02	54	317	42	27	310	30	14	277	57	19	33	49	15	306	01	54	303	15	17
	16	296	04	02	330	55	21	312	03	37	279	12	33	34	18	40	306	16	02	303	22	23
	17	297	05	09	343	47	23	313	35	14	280	27	46	34	48	17	306	30	10	303	29	30
	18	298	06	16	356	19	39	315	04	42	281	42	59	35	18	06	306	44	19	303	36	37
	19	299	07	21	8	34	45	316	31	34	282	58	12	35	48	06	306	58	30	303	43	45
	20	300	08	26	20	36	29	317	55	18	284	13	25	36	18	17	307	12	41	303	50	53
	21	301	09	31	32	29	26	319	15	21	285	28	38	36	48	39	307	26	53	303	58	01
	22	302	10	34	44	18	44	320	31	02	286	43	50	37	19	11	307	41	05	304	05	10
	23	303	11	36	56	09	37	321	41	39	287	59	03	37	49	53	307	55	18	304	12	19
	24	304	12	37	68	07	12	322	46	28	289	14	15	38	20	45	308	09	32	304	19	27
	25	305	13	38	80	16	05	323	44	37	290	29	27	38	51	46	308	23	46	304	26	35
	26	306	14	37	92	40	10	324	35	19	291	44	40	39	22	57	308	38	01	304	33	44
	27	307	15	36	105	22	12	325	17	40	292	59	51	39	54	16	308	52	16	304	40	53
	28	308	16	33	118	23	34	325	50	53	294	15	03	40	25	44	309	06	31	304	48	02
	29	309	17	30	131	44	05	326	14	13	295	30	15	40	57	20	309	20	46	304	55	10
	30	310	18	25	145	21	56	326	27	01	296	45	26	41	29	04	309	35	00	305	02	18
	31	311	19	20	159	13	58	326	28	49	298	00	37	42	00	56	309	49	16	305	09	25

LONGITUDE OF SUN, MOON AND PLANETS, 2021

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 29^m.0$ I.S.T.

Date	Sun			Moon			Mercury			Venus			Mars			Jupiter			Saturn		
	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
Feb. 1	312	20	13	173	16	11	326	19	22	299	15	48	42	32	55	310	03	31	305	16	32
2	313	21	06	187	24	23	325	58	41	300	30	59	43	05	02	310	17	45	305	23	38
3	314	21	58	201	34	50	325	27	08	301	46	10	43	37	16	310	32	00	305	30	44
4	315	22	49	215	44	36	324	45	22	303	01	21	44	09	38	310	46	15	305	37	49
5	316	23	40	229	51	48	323	54	27	304	16	31	44	42	07	311	00	29	305	44	54
6	317	24	29	243	55	16	322	55	46	305	31	42	45	14	43	311	14	42	305	51	57
7	318	25	18	257	54	16	321	50	59	306	46	53	45	47	25	311	28	56	305	59	00
8	319	26	06	271	47	58	320	41	58	308	02	03	46	20	15	311	43	08	306	06	02
9	320	26	53	285	35	08	319	30	43	309	17	13	46	53	11	311	57	20	306	13	04
10	321	27	39	299	13	58	318	19	14	310	32	23	47	26	14	312	11	31	306	20	03
11	322	28	23	312	42	12	317	09	24	311	47	32	47	59	23	312	25	42	306	27	02
12	323	29	06	325	57	30	316	02	54	313	02	41	48	32	37	312	39	51	306	33	60
13	324	29	48	338	57	51	315	01	11	314	17	50	49	05	58	312	53	59	306	40	56
14	325	30	28	351	42	03	314	05	24	315	32	58	49	39	25	313	08	06	306	47	51
15	326	31	07	4	10	06	313	16	25	316	48	05	50	12	57	313	22	12	306	54	44
16	327	31	44	16	23	17	312	34	46	318	03	12	50	46	35	313	36	16	307	01	36
17	328	32	19	28	24	13	312	00	48	319	18	18	51	20	18	313	50	19	307	08	26
18	329	32	53	40	16	35	311	34	36	320	33	23	51	54	07	314	04	20	307	15	14
19	330	33	25	52	05	02	311	16	07	321	48	28	52	27	60	314	18	20	307	22	01
20	331	33	55	63	54	45	311	05	08	323	03	32	53	01	58	314	32	19	307	28	46
21	332	34	23	75	51	16	311	01	23	324	18	36	53	36	01	314	46	15	307	35	30
22	333	34	49	88	00	06	311	04	30	325	33	39	54	10	08	315	00	10	307	42	11
23	334	35	14	100	26	18	311	14	07	326	48	41	54	44	19	315	14	03	307	48	51
24	335	35	37	113	14	01	311	29	50	328	03	42	55	18	35	315	27	54	307	55	28
25	336	35	58	126	25	54	311	51	14	329	18	43	55	52	55	315	41	43	308	02	03
26	337	36	16	140	02	33	312	17	57	330	33	43	56	27	18	315	55	30	308	08	36
27	338	36	34	154	02	08	312	49	35	331	48	42	57	01	46	316	09	15	308	15	07
28	339	36	49	168	20	24	313	25	47	333	03	41	57	36	16	316	22	57	308	21	36

LONGITUDE OF SUN, MOON AND PLANETS, 2021

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 29^m.0$ I.S.T.

Date		Sun			Moon			Mercury			Venus			Mars			Jupiter			Saturn		
		°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
Mar	1	340	37	02	182	51	08	314	06	14	334	18	38	58	10	51	316	36	37	308	28	02
	2	341	37	14	197	27	07	314	50	37	335	33	36	58	45	29	316	50	15	308	34	25
	3	342	37	24	212	01	29	315	38	40	336	48	32	59	20	10	317	03	50	308	40	47
	4	343	37	33	226	28	39	316	30	06	338	03	28	59	54	55	317	17	23	308	47	06
	5	344	37	41	240	44	55	317	24	41	339	18	24	60	29	43	317	30	53	308	53	22
	6	345	37	46	254	48	30	318	22	14	340	33	19	61	04	34	317	44	21	308	59	36
	7	346	37	51	268	39	04	319	22	31	341	48	14	61	39	29	317	57	46	309	05	47
	8	347	37	54	282	17	11	320	25	23	343	03	08	62	14	27	318	11	08	309	11	55
	9	348	37	55	295	43	36	321	30	40	344	18	01	62	49	29	318	24	27	309	18	00
	10	349	37	54	308	58	57	322	38	13	345	32	53	63	24	33	318	37	43	309	24	03
	11	350	37	52	322	03	22	323	47	55	346	47	45	63	59	40	318	50	56	309	30	02
	12	351	37	48	334	56	36	324	59	40	348	02	36	64	34	51	319	04	05	309	35	58
	13	352	37	42	347	38	10	326	13	20	349	17	26	65	10	04	319	17	11	309	41	51
	14	353	37	34	0	07	42	327	28	51	350	32	15	65	45	20	319	30	14	309	47	41
	15	354	37	24	12	25	15	328	46	08	351	47	03	66	20	39	319	43	13	309	53	28
	16	355	37	12	24	31	38	330	05	07	353	01	50	66	56	01	319	56	09	309	59	11
	17	356	36	58	36	28	34	331	25	44	354	16	37	67	31	25	320	09	01	310	04	51
	18	357	36	41	48	18	44	332	47	56	355	31	22	68	06	51	320	21	49	310	10	27
	19	358	36	23	60	05	46	334	11	40	356	46	06	68	42	20	320	34	34	310	16	00
	20	359	36	02	71	54	10	335	36	54	358	00	50	69	17	52	320	47	14	310	21	30
	21	0	35	40	83	49	00	337	03	36	359	15	32	69	53	25	320	59	51	310	26	56
	22	1	35	14	95	55	44	338	31	44	0	30	13	70	29	01	321	12	23	310	32	18
	23	2	34	47	108	19	49	340	01	17	1	44	53	71	04	39	321	24	51	310	37	36
	24	3	34	17	121	06	16	341	32	14	2	59	32	71	40	18	321	37	15	310	42	51
	25	4	33	45	134	18	57	343	04	34	4	14	09	72	15	60	321	49	35	310	48	01
	26	5	33	11	147	59	53	344	38	16	5	28	46	72	51	43	322	01	50	310	53	08
	27	6	32	34	162	08	32	346	13	20	6	43	21	73	27	28	322	14	00	310	58	11
	28	7	31	56	176	41	17	347	49	46	7	57	55	74	03	14	322	26	06	311	03	10
	29	8	31	15	191	31	36	349	27	35	9	12	28	74	39	02	322	38	08	311	08	04
	30	9	30	32	206	30	50	351	06	45	10	27	00	75	14	52	322	50	04	311	12	55
	31	10	29	47	221	29	42	352	47	18	11	41	31	75	50	43	323	01	56	311	17	41

LONGITUDE OF SUN, MOON AND PLANETS, 2021

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 29^m.0$ I.S.T.

Date		Sun			Moon			Mercury			Venus			Mars			Jupiter			Saturn		
		°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
Apr	1	11	29	00	236	19	46	354	29	15	12	56	02	76	26	36	323	13	43	311	22	24
	2	12	28	12	250	54	44	356	12	35	14	10	31	77	02	31	323	25	25	311	27	02
	3	13	27	21	265	10	52	357	57	19	15	24	59	77	38	27	323	37	02	311	31	36
	4	14	26	30	279	06	49	359	43	29	16	39	27	78	14	24	323	48	34	311	36	05
	5	15	25	36	292	43	01	1	31	04	17	53	53	78	50	24	324	00	00	311	40	30
	6	16	24	41	306	00	60	3	20	05	19	08	19	79	26	24	324	11	22	311	44	51
	7	17	23	43	319	02	46	5	10	33	20	22	44	80	02	27	324	22	37	311	49	07
	8	18	22	44	331	50	18	7	02	27	21	37	07	80	38	30	324	33	47	311	53	18
	9	19	21	43	344	25	21	8	55	49	22	51	30	81	14	36	324	44	52	311	57	24
	10	20	20	41	356	49	19	10	50	38	24	05	51	81	50	42	324	55	50	312	01	26
	11	21	19	36	9	03	23	12	46	54	25	20	12	82	26	50	325	06	43	312	05	23
	12	22	18	29	21	08	37	14	44	36	26	34	31	83	02	60	325	17	29	312	09	15
	13	23	17	20	33	06	15	16	43	41	27	48	49	83	39	11	325	28	10	312	13	03
	14	24	16	10	44	57	54	18	44	09	29	03	06	84	15	23	325	38	44	312	16	45
	15	25	14	57	56	45	39	20	45	56	30	17	22	84	51	37	325	49	13	312	20	22
	16	26	13	42	68	32	17	22	48	57	31	31	37	85	27	51	325	59	34	312	23	55
	17	27	12	25	80	21	13	24	53	08	32	45	51	86	04	07	326	09	50	312	27	22
	18	28	11	06	92	16	34	26	58	22	34	00	03	86	40	24	326	19	59	312	30	45
	19	29	09	45	104	22	56	29	04	32	35	14	15	87	16	42	326	30	01	312	34	02
	20	30	08	22	116	45	12	31	11	26	36	28	24	87	53	01	326	39	56	312	37	14

SUN AND MOON, 2021

DECLINATION OF SUN, LATITUDE AND DECLINATION OF MOON FOR $5^h\ 29^m.0$ I.S.T.

Date		Declination of Sun		Latitude of Moon		Declination of Moon		Date		Declination of Sun		Latitude of Moon		Declination of Moon	
		°	'	°	'	°	'			°	'	°	'	°	'
Jan.	0	-23	04.7	+2	37.1	+24	34.2	Feb.	1	-17	05.9	+5	04.7	+7	20.0
	1	22	60.0	3	34.3	23	01.5		2	16	48.7	4	49.1	+1	29.3
	2	22	54.8	4	21.2	20	13.1		3	16	31.2	4	15.9	-4	27.2
	3	22	49.2	4	54.6	16	18.5		4	16	13.4	3	27.0	10	10.7
	4	22	43.1	5	12.0	11	30.7		5	15	55.3	2	25.6	15	21.9
	5	22	36.6	5	11.9	6	05.1		6	15	36.9	1	15.6	19	41.6
	6	22	29.6	4	53.5	+0	17.4		7	15	18.3	+0	01.6	22	51.6
	7	22	22.2	4	17.4	-5	35.1		8	14	59.4	-1	12.0	24	37.5
	8	22	14.3	3	25.3	11	14.2		9	14	40.3	2	20.7	24	51.3
	9	22	06.0	2	20.1	16	19.5		10	14	20.9	3	20.3	23	34.5
	10	21	57.3	1	06.0	20	29.6		11	14	01.3	4	07.9	20	57.3
	11	21	48.1	0	12.2	23	23.7		12	13	41.4	4	41.1	17	16.1
	12	21	38.5	1	29.0	24	46.3		13	13	21.3	4	58.9	12	49.2
	13	21	28.5	2	39.3	24	31.6		14	13	01.0	5	01.3	7	54.2
	14	21	18.1	3	38.8	22	45.4		15	12	40.5	4	49.1	-2	46.0
	15	21	07.2	4	24.5	19	43.1		16	12	19.8	4	23.8	+2	22.9
	16	20	56.0	4	54.8	15	44.0		17	11	58.9	3	47.1	7	22.0
	17	20	44.4	5	09.2	11	07.6		18	11	37.8	3	00.8	12	02.2
	18	20	32.3	5	08.2	6	10.3		19	11	16.5	2	07.0	16	14.5
	19	20	19.9	4	53.0	-1	05.3		20	10	55.0	1	07.6	19	49.4
	20	20	07.1	4	25.1	+3	57.0		21	10	33.4	-0	04.7	22	36.5
	21	19	53.9	3	46.1	8	47.7		22	10	11.6	+0	59.4	24	24.7
	22	19	40.4	2	57.6	13	18.2		23	9	49.7	2	02.1	25	03.4
	23	19	26.5	2	01.4	17	19.4		24	9	27.6	3	00.4	24	24.0
	24	19	12.2	-0	59.4	20	40.9		25	9	05.3	3	50.8	22	23.2
	25	18	57.6	+0	06.1	23	10.9		26	8	43.0	4	29.8	19	03.7
	26	18	42.6	1	12.5	24	37.1		27	8	20.5	4	53.7	14	35.1
	27	18	27.3	2	16.7	24	48.9		28	-7	57.8	+5	00.0	+9	12.6
	28	18	11.7	3	15.3	23	40.1								
	29	17	55.7	4	04.6	21	10.8								
	30	17	39.4	4	41.1	17	28.3								
	31	-17	22.8	+5	01.8	+12	45.8								

SUN AND MOON, 2021

DECLINATION OF SUN, LATITUDE AND DECLINATION OF MOON FOR $5^h\ 29^m.0$ I.S.T.

Date		Declination of Sun		Latitude of Moon		Declination of Moon		Date		Declination of Sun		Latitude of Moon		Declination of Moon	
		°	'	°	'	°	'			°	'	°	'	°	'
Mar.	1	-7	35.1	+4	47.2	+3	15.5	Apr	1	+4	32.5	+1	25.5	-17	56.6
	2	7	12.3	4	15.7	-2	54.7		2	4	55.6	+0	08.7	21	56.1
	3	6	49.3	3	27.5	8	55.7		3	5	18.6	-1	07.1	24	28.1
	4	6	26.3	2	26.2	14	25.6		4	5	41.6	2	17.3	25	24.4
	5	6	03.1	1	16.4	19	03.6		5	6	04.4	3	17.9	24	46.6
	6	5	39.9	+0	02.9	22	31.4		6	6	27.1	4	06.4	22	44.6
	7	5	16.6	-1	09.7	24	35.5		7	6	49.8	4	41.0	19	33.4
	8	4	53.2	2	17.1	25	08.7		8	7	12.3	5	00.8	15	29.8
	9	4	29.8	3	15.9	24	12.2		9	7	34.6	5	05.6	10	49.6
	10	4	06.3	4	03.1	21	54.9		10	7	56.9	4	55.9	-5	47.3
	11	3	42.8	4	36.7	18	30.9		11	8	19.0	4	32.7	+0	35.3
	12	3	19.2	4	55.7	14	16.7		12	8	41.0	3	57.3	4	34.8
	13	2	55.5	4	59.6	9	28.7		13	9	02.9	3	11.8	9	32.4
	14	2	31.9	4	48.9	-4	22.0		14	9	24.6	2	18.1	14	07.4
	15	2	08.2	4	24.8	+0	50.5		15	9	46.1	1	18.6	18	09.4
	16	1	44.4	3	49.0	5	57.0		16	10	07.5	-0	15.7	21	28.0
	17	1	20.7	3	03.4	10	47.3		17	10	28.7	+0	48.2	23	53.3
	18	0	57.0	2	10.1	15	11.7		18	10	49.7	1	50.7	25	15.8
	19	0	33.3	1	11.3	19	00.4		19	11	10.5	2	49.3	25	28.0
	20	-0	09.5	-0	09.3	22	03.7		20	+11	31.2	+3	41.4	+24	25.4
	21	+0	14.2	+0	53.8	24	11.4								
	22	0	37.9	1	55.6	25	13.8								
	23	1	01.6	2	53.4	25	02.8								
	24	1	25.2	3	44.3	23	33.4								
	25	1	48.8	4	25.1	20	45.5								
	26	2	12.4	4	52.4	16	44.2								
	27	2	35.9	5	03.0	11	40.1								
	28	2	59.3	4	54.6	5	49.2								
	29	3	22.7	4	26.4	+0	28.2								
	30	3	46.1	3	39.7	-6	48.7								
	31	+4	09.3	+2	37.8	-12	46.6								

PLANETS, 2021

GEOCENTRIC LATITUDE AND DECLINATION FOR $5^{h}\ 29^{m}.0$ I.S.T.

Date	Mercury Latitude	Mercury Declination	Venus Latitude	Venus Declination	Mars Latitude	Mars Declination	Jupiter Latitude	Jupiter Declination	Saturn Latitude	Saturn Declination
	° '	° '	° '	° '	° '	° '	° '	° '	° '	° '
Jan. 0	-2 04.6	-24 31.8	+0 42.0	-22 17.8	+0 51.1	+11 10.3	+0 29.3	-20 03.8	+0 23.2	-20 11.9
2	2 07.4	24 08.6	0 37.0	22 33.5	0 53.5	11 31.1	0 29.5	19 57.6	0 23.3	20 09.0
4	2 08.7	23 39.3	0 32.0	22 46.5	0 55.7	11 52.2	0 29.6	19 51.4	0 23.5	20 06.1
6	2 08.1	23 03.8	0 26.9	22 56.8	0 57.8	12 13.3	0 29.7	19 45.0	0 23.6	20 03.1
8	2 05.6	22 22.1	0 21.8	23 04.3	0 59.8	12 34.6	0 29.8	19 38.6	0 23.7	20 00.0
10	2 00.9	21 34.3	0 16.7	23 08.9	1 01.7	12 56.0	0 30.0	19 32.0	0 23.8	19 56.9
12	1 53.8	20 40.8	0 11.5	23 10.7	1 03.6	13 17.4	0 30.1	19 25.3	0 24.0	19 53.8
14	1 44.0	19 41.8	0 06.4	23 09.7	1 05.3	13 38.8	0 30.2	19 18.6	0 24.1	19 50.7
16	1 31.2	18 38.1	0 01.3	23 05.8	1 06.9	14 00.3	0 30.4	19 11.7	0 24.2	19 47.5
18	1 15.3	17 30.6	0 03.8	22 59.0	1 08.4	14 21.8	0 30.5	19 04.8	0 24.4	19 44.4
20	0 55.8	16 20.7	0 08.9	22 49.5	1 09.9	14 43.2	0 30.7	18 57.7	0 24.5	19 41.1
22	0 32.8	15 10.1	0 13.8	22 37.1	1 11.3	15 04.6	0 30.9	18 50.6	0 24.6	19 37.9
24	-0 06.1	14 01.2	0 18.7	22 22.0	1 12.6	15 25.9	0 31.0	18 43.4	0 24.8	19 34.7
26	+0 24.0	12 56.9	0 23.5	22 04.1	1 13.8	15 47.0	0 31.2	18 36.2	0 24.9	19 31.4
28	0 56.9	12 00.6	0 28.2	21 43.6	1 15.0	16 08.1	0 31.3	18 28.8	0 25.1	19 28.1
30	1 31.5	11 15.8	0 32.8	21 20.4	1 16.1	16 28.9	0 31.5	18 21.4	0 25.2	19 24.8
Feb. 1	2 06.3	10 45.6	0 37.3	20 54.7	1 17.2	16 49.6	0 31.7	18 13.9	0 25.4	19 21.5
3	2 39.0	10 32.3	0 41.6	20 26.4	1 18.1	17 10.1	0 31.9	18 06.4	0 25.5	19 18.2
5	3 06.9	10 36.5	0 45.8	19 55.8	1 19.1	17 30.4	0 32.1	17 58.8	0 25.7	19 14.8
7	3 27.6	10 56.7	0 49.9	19 22.8	1 19.9	17 50.4	0 32.2	17 51.1	0 25.8	19 11.5
9	3 39.3	11 29.6	0 53.7	18 47.6	1 20.7	18 10.1	0 32.4	17 43.4	0 26.0	19 08.2
11	3 41.3	12 10.5	+0 57.4	18 10.1	1 21.5	18 29.6	0 32.6	17 35.7	0 26.1	19 04.9
13	3 34.3	12 54.7	-1 00.9	17 30.6	1 22.2	18 48.8	0 32.8	17 27.9	0 26.3	19 01.5
15	3 19.9	13 38.3	1 04.2	16 49.2	1 22.9	19 07.7	0 33.0	17 20.0	0 26.5	18 58.2
17	3 00.1	14 18.3	1 07.3	16 05.8	1 23.5	19 26.2	0 33.3	17 12.2	0 26.7	18 54.9
19	2 36.7	14 52.9	1 10.2	15 20.6	1 24.1	19 44.4	0 33.5	17 04.3	0 26.8	18 51.6
21	2 11.5	15 21.2	1 12.8	14 33.7	1 24.6	20 02.2	0 33.7	16 56.3	0 27.0	18 48.3
23	1 45.6	15 42.7	1 15.3	13 45.2	1 25.1	20 19.7	0 33.9	16 48.4	0 27.2	18 45.1
25	1 19.7	15 57.4	1 17.5	12 55.3	1 25.6	20 36.7	0 34.2	16 40.4	0 27.4	18 41.9
27	+0 54.6	-16 05.2	-1 19.4	-12 03.9	+1 26.0	+20 53.3	+0 34.4	-16 32.4	+0 27.5	-18 38.6

PLANETS, 2021

GEOCENTRIC LATITUDE AND DECLINATION FOR $5^{h}\ 29^{m}.0$ I.S.T.

Date	Mercury		Venus		Mars		Jupiter		Saturn	
	Latitude	Declination	Latitude	Declination	Latitude	Declination	Latitude	Declination	Latitude	Declination
	° '	°	° '	° '	° '	° '	° '	° '	° '	° '
Mar. 1	+0 30.5	-16 06.5	-1 21.1	-11 11.3	+1 26.4	+21 09.4	+0 34.6	-16 24.4	+0 27.7	-18 35.5
3	0 07.7	16 01.3	1 22.6	10 17.4	1 26.8	21 25.1	0 34.9	16 16.4	0 27.9	18 32.3
5	+0 13.6	15 49.9	1 23.8	9 22.5	1 27.1	21 40.3	0 35.1	16 08.4	0 28.1	18 29.2
7	-0 33.4	15 32.3	1 24.8	8 26.5	1 27.4	21 55.1	0 35.4	16 00.5	0 28.3	18 26.1
9	0 51.7	15 08.9	1 25.5	7 29.6	1 27.7	22 09.3	0 35.7	15 52.5	0 28.5	18 23.1
11	1 08.3	14 39.7	1 26.0	6 32.0	1 27.9	22 23.1	0 35.9	15 44.5	0 28.7	18 20.1
13	1 23.3	14 04.9	1 26.2	5 33.6	1 28.1	22 36.3	0 36.2	15 36.6	0 28.9	18 17.1
15	1 36.7	13 24.7	1 26.2	4 34.7	1 28.3	22 48.9	0 36.5	15 28.7	0 29.1	18 14.2
17	1 48.3	12 39.1	1 25.9	3 35.2	1 28.5	23 01.1	0 36.8	15 20.8	0 29.3	18 11.3
19	1 58.3	11 48.4	1 25.3	2 35.4	1 28.6	23 12.6	0 37.1	15 13.0	0 29.6	18 08.5
21	2 06.5	10 52.5	1 24.5	1 35.2	1 28.7	23 23.6	0 37.3	15 05.2	0 29.8	18 05.8
23	2 13.0	9 51.7	1 23.4	-0 34.8	1 28.8	23 34.0	0 37.7	14 57.4	0 30.0	18 03.1
25	2 17.7	8 46.1	1 22.1	+0 25.6	1 28.9	23 43.8	0 38.0	14 49.8	0 30.2	18 00.4
27	2 20.6	7 35.7	1 20.6	1 26.1	1 28.9	23 53.0	0 38.3	14 42.1	0 30.4	17 57.9
29	2 21.6	6 20.6	1 18.8	2 26.5	1 28.9	24 01.6	0 38.6	14 34.6	0 30.7	17 55.4
31	2 20.8	5 01.0	1 16.8	3 26.7	1 28.9	24 09.5	0 38.9	14 27.1	0 30.9	17 53.0
Apr. 2	2 18.0	3 37.1	1 14.5	4 26.7	1 28.9	24 16.9	0 39.3	14 19.7	0 31.1	17 50.6
4	2 13.3	2 08.9	1 12.0	5 26.3	1 28.9	24 23.5	0 39.6	14 12.4	0 31.4	17 48.3
6	2 06.6	-0 36.7	1 09.3	6 25.4	1 28.8	24 29.6	0 40.0	14 05.1	0 31.6	17 46.1
8	1 57.9	+0 59.4	1 06.4	7 24.0	1 28.7	24 34.9	0 40.3	13 58.0	0 31.8	17 44.0
10	1 47.1	2 38.9	1 03.3	8 21.9	1 28.6	24 39.7	0 40.7	13 51.0	0 32.1	17 42.0
12	1 34.3	4 21.6	1 00.0	9 19.0	1 28.5	24 43.7	0 41.0	13 44.0	0 32.3	17 40.0
14	1 19.6	6 06.8	0 56.5	10 15.3	1 28.4	24 47.1	0 41.4	13 37.2	0 32.6	17 38.2
16	1 03.0	7 53.8	0 52.9	11 10.7	1 28.3	24 49.8	0 41.8	13 30.5	0 32.8	17 36.4
18	0 44.7	9 41.9	0 49.0	12 04.9	1 28.1	24 51.8	0 42.2	13 24.0	0 33.1	17 34.7
20	-0 25.0	+11 29.8	-0 45.0	+12 58.1	+1 28.0	+24 53.2	+0 42.6	-13 17.5	+0 33.4	-17 33.1

URANUS, NEPTUNE AND PLUTO, 2021

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 29^m.0$ I.S.T.

Date	Uranus	Neptune	Pluto	Date	Uranus	Neptune	Pluto
	° ' "	° ' "	° ' "		° ' "	° ' "	° ' "
Jan. 0	36 48 40	348 27 19	294 09 20	Feb. 25	37 27 30	350 06 17	295 55 29
2	36 47 18	348 29 32	294 13 15	27	37 31 41	350 10 45	295 58 39
4	36 46 07	348 31 53	294 17 11	Mar. 1	37 36 01	350 15 15	296 01 44
6	36 45 08	348 34 20	294 21 08	3	37 40 31	350 19 45	296 04 45
8	36 44 22	348 36 55	294 25 06	5	37 45 10	350 24 17	296 07 41
10	36 43 48	348 39 37	294 29 05	7	37 49 58	350 28 50	296 10 32
12	36 43 27	348 42 26	294 33 05	9	37 54 55	350 33 23	296 13 18
14	36 43 19	348 45 22	294 37 05	11	38 00 00	350 37 57	296 15 58
16	36 43 23	348 48 24	294 41 04	13	38 05 14	350 42 30	296 18 33
18	36 43 39	348 51 32	294 45 04	15	38 10 35	350 47 03	296 21 02
20	36 44 08	348 54 46	294 49 03	17	38 16 04	350 51 36	296 23 25
22	36 44 50	348 58 06	294 53 02	19	38 21 40	350 56 08	296 25 42
24	36 45 45	349 01 31	294 56 59	21	38 27 24	351 00 39	296 27 54
26	36 46 52	349 05 03	295 00 56	23	38 33 14	351 05 09	296 29 59
28	36 48 12	349 08 39	295 04 52	25	38 39 10	351 09 37	296 31 58
30	36 49 44	349 12 21	295 08 46	27	38 45 12	351 14 04	296 33 50
Feb. 1	36 51 28	349 16 07	295 12 38	29	38 51 20	351 18 28	296 35 36
3	36 53 24	349 19 58	295 16 28	31	38 57 33	351 22 51	296 37 15
5	36 55 32	349 23 53	295 20 15	Apr. 2	39 03 52	351 27 11	296 38 48
7	36 57 53	349 27 52	295 24 01	4	39 10 15	351 31 29	296 40 15
9	37 00 25	349 31 56	295 27 45	6	39 16 43	351 35 44	296 41 34
11	37 03 09	349 36 03	295 31 25	8	39 23 14	351 39 55	296 42 47
13	37 06 05	349 40 14	295 35 02	10	39 29 50	351 44 04	296 43 53
15	37 09 12	349 44 28	295 38 36	12	39 36 28	351 48 08	296 44 51
17	37 12 30	349 48 45	295 42 06	14	39 43 10	351 52 09	296 45 43
19	37 15 59	349 53 04	295 45 32	16	39 49 55	351 56 07	296 46 28
21	37 19 39	349 57 26	295 48 55	18	39 56 43	351 59 60	296 47 05
23	37 23 30	350 01 51	295 52 14	20	40 03 33	352 03 49	296 47 36
25	37 27 30	350 06 17	295 55 29	22	40 10 24	352 07 33	296 48 00

EXPLANATION

In the following pages, a short explanation of the terms used in this Ephemeris has been given and the scope and limitations of the information furnished have been stated in a concise form. The values of the different constants and other data upon which the tabulated quantities are based have also been given in some cases in order to facilitate the use of this Ephemeris. It is not intended to furnish here any detailed explanation about the compilation of the tabular matter for which the reader is referred to the relevant literature.

Many changes have been incorporated in this publication from time to time including several recomendations of IAU at its General Assembly.

THE STANDARD EPOCH AND TIME SCALES

There are two classes of time scales used in Astronomy, one based on the Systeme International (SI) - the atomic second, the other based on the rotation of the Earth. Time scales based on the SI second include TAI and TT for practical applications. Time scale based on the rotation of the Earth include mean and apparent sidereal time and UT1. Because of irregularites in the Earth's rotation and its tidal deceleration, Earth's rotation based time scales do not advance at a uniform rate, and they increasingly lag behind the SI-second-based time scales. The widely disseminated time scale UTC is a hybrid, it advances by SI seconds but is subjct to one-second corrections (leap seconds) to keep it within $0^{s}.9$ of UT1.

The standard epoch J 2000.0 corresponds to 2000 January 1, 12^{h} TT (JD 245 1545.0 TT). A date may be expressed in years as a Julian epoch or for some purposes as a Besselian epoch.

Julian epoch = J [2000.0 + (JD − 245 1545.0)/ 365.25]
Where the quantity in the denominator is the Julian year.

Besselian epoch= B [1900.0 + (JD − 241 5020.313 52)/ 365.242 198 781]
Where the quantity in the denominator is the length of tropical year.

Prefixes J and B stand for the Julian and Besselian epochs respectively.

Various time systems used in this publication and their inter-relationships are described below :

Sidereal time system is derived from the Earth's rotation with respect to the stars. Local sidereal time is defined as the local hour angle of the vernal equinox. It is 0^{h} at the instant when the vernal equinox is at the upper transit of the local meridian. It is determined from observation of meridian transits of known stars. As the equinox oscillates about its mean position due to the effect of nutation, it gives rise to two kinds of sidereal time : the apparent sidereal time which is the hour angle of the true equinox of date and the mean sidereal time which is the hour angle of the mean equinox of date. The relation between the two is:

Apparent sidereal time = Mean sidereal time + Equation of Equinoxes

Equation of equinoxes is the total nutation in longitude multiplied by the cosine of the obliquity of the ecliptic. Its value varies within $\pm$ 1.2 seconds of time in a period of about 18.6 years.

Sidereal time on the geographic meridian of Greenwich is known as Greenwich sidereal time. Local sidereal time is related to Greenwich sidereal time (mean or apparent as appropriate) as follows:

Local sidereal time = Greenwich sidereal time + λ, where λ is the observer's longitude measured positively to the east (from 1985 onwards the sign convention for east terrestrial longitude to be positive has been adopted).

International Atomic Time (TAI) is a highly precise time scale given by atomic clocks. It is now being used as a standard in astronomy as it is independent of the Earth's rotation. Its fundamental unit, the SI second, is

EXPLANATION

defined as the duration of 9 192 631 770 cycles of the radiation corresponding to the transition between two hyperfine levels of the ground state of the Cesium 133 atom. This time scale results from analysis of data from atomic time standards of many countries carried out at the Bureau International de l ' Heure in Paris.

Universal Time (UT) is used for civil time keeping. It is an outgrowth of the mean solar time system derived from the Earth's rotation with respect to the Sun. It has been formally defined through a strict relationship with the Greenwich mean sidereal time and is, therefore, determined from observation of star transits. The universal time directly derived from observation is designated UT_o. It contains nonuniformities due to variations in the rotation of the Earth and is peculiar to the observer's geographic location because of polar motion. When UT_o is corrected for Earth's polar motion, it is called UT1. When UT1 is further corrected for seasonal variation in the Earth's rotation, it is called UT2. Both UT_o and UT2 are not for general usage. Instead, the national time services provide what is known as co-ordinated universal time (UTC). It is a smoothed version of UT2 and differs from TAI by an integral number of seconds. It contains step adjustments of exactly one second (leap seconds) in order to keep it always within 0.90 seconds of UT1. Beginning with 1972, the step adjustments are usually inserted after the 60^{th} second of the last minute of December 31 or June 30. In this publication, UT1 has been used in computations relating to hour angles, etc., unless otherwise stated.

Dynamical Time replaces ephemeris time (ET) as argument of ephemerides with effect from 1985 in this publication. The concept of different dynamical times for observers in different frames of reference arises out of general theory of relativity. In this publication, terrestrial time (TT) is the tabular argument of the fundamental geocentric ephemerides and barycentric dynamical time (TDB) is the arguments of ephemerides referred to the barycentre of the solar system. The former corresponds to proper time and the latter to co-ordinate time in terms of the general theory of relativity. Both TT and TDB are independent of the Earth's rotation. These scales are so defined that the difference between them is purely periodic. Their difference is given by:-

$TDB = TT + 0^s.001\,657 \sin g + 0^s.000\,022 \sin(L - L_J)$, where higher order terms have been neglected. Here g is the mean anomaly of the Earth in its orbit around the Sun and is given by:-

$$g = 357^\circ.53 + 0^\circ.985\,600\,28\,(JD - 245\,1545.0)$$
$$L - L_J = 246^\circ.11 + 0.902\,517\,92\,(JD - 245\,1545.0)$$

Where $L - L_J$ is the difference in the mean longitude of the Sun and Jupiter.

Relationship Between universal time and sidereal time

Universal time is defined in terms of Greenwich mean sidereal time by:

$$\text{GMST at } 0^h\ \text{UT1} = 6^h\ 41^m\ 50^s.549\,377 + 864\,018\,4^s.704\,478\,T_u + 0^s.092\,772\,T_u^2 - 2^s.93 \times 10^{-8}\,T_u^3 - 1^s.997 \times 10^{-6}\,T_u^4 - 2^s.5 \times 10^{-9}\,T_u^5$$

where T_u is the number of Julian centuries of 36525 days of universal time elapsed since 1 January, 2000,12^h UT (JD 245 154 5.0). In other words,

$$T_u = (JD - 245\,1545.0)/36525$$

The above expression implies that the ratio of UT1 to GMST at the epoch J2000.0 is 0.997 269 566 329 084 and its inverse is 1.002 737 909 350 795.

The following relationship holds during 2020:

On day of year d at t^h UT1 GMST = $6^h.609\,0775 + 0^h.065\,709\,8246\,d + 1^h.002\,737\,91\,t$

where day of the year d is tabulated on pages 4 to 12.

EXPLANATION

In 2020 :

1 mean solar day = 1.002 737 909 35 mean sidereal days
= $24^h\ 03^m\ 56^s.555\ 37$ of mean sidereal time

1 mean sidereal day = 0.997 269 566 33 mean solar days
= $23^h\ 56^m\ 04^s.090\ 53$ of mean solar time

Conversion of local mean time to local sidereal time

Calculate local sidereal time at $15^h\ 54^m\ 42^s$ L.M.T. on 2020 January 1, for Delhi longitude,

$\lambda = 77° 13' 00''$ East ($5^h\ 08^m\ 52^s$)

		h	m	s
1.	Universal time = Local mean time $-\lambda$	10	45	50
2.	Greenwich mean sidereal time at 0^h U.T. on January 1, 2020 (Page 13).	6	40	29.234
		h	m	s
3.	Add equivalent mean sidereal time for 10 45 50 (UT $\times$ 1.002 737 9093).	10	47	36.094
4.	Greenwich mean sidereal time at desired L.M.T.	17	28	5.328285
5.	Add equation of equinoxes at UT=0^d. 45 (second order interpolation may be used).			-1.010
6.	Greenwich apparent sidereal time	17	28	4.318
7.	Add longitude (east positive)	5	08	52.000
8.	Local apparent sidereal time	22	36	56.318

For local mean sidereal time, the above process may be repeated by neglecting the equation of equinoxes.

Conversion of local sidereal time to local mean time

Calculate local mean time at $22^h\ 38^m\ 51^s.206$ local apparent sidereal time on 2020 January 1, for Delhi longitude, $\lambda = 77° 13' 00''$ East ($5^h\ 08^m\ 52^s$)

		h	m	s
1.	Local apparent sidereal time	22	36	56.318
2.	Subtract longitude (east positive)	5	08	52.000
3.	Greenwich apparent sidereal time	17	28	4.318
4.	Subtract equation of equinox at 0^h U.T.			-1.009
5.	Greenwich mean sidereal time (provisional)	17	28	5.327
6.	Subtract Greenwich mean sidereal time at 0^h U.T.	6	40	29.234
7.	Mean sidereal time interval (provisional) M.S.T. (P)	10	47	36.093

EXPLANATION

7.	Mean sidereal time interval (provisional) M.S.T. (P)	10	47	36.096
8.	Mean time interval in days corresponding to (7) above = (M.S.T. (P) $\times$ 0.997 269 566) = $0^d.45$ (UT). Subtract the increment to equation of equinoxes for $0^d.45$ UT (using second order interpolation)	(-)		0.00310
9.	Mean sidereal time	10	47	36.096
10.	Equivalent UT (MST $\times$ 0.997 269 566)	10	45	50.002
11.	Local mean time = UT + λ	15	54	42.002

The mean time from the local mean sidereal time may be worked out on similar lines as above by neglecting the equation of equinoxes.

Notation for time-scales and related quantities

UT1	Universal time (also UT); counted from 0^h (mid night); unit is second of mean solar time, affected by iregularities in the Earth's rate of rotation.
UT0	local approximation to universal time; not corrected for polar motion (rarely used).
GMST	Greenwich mean sidereal time; GHA of mean equinox of date.
GAST	Greenwich apparent sidereal time; GHA of true Eqinox of date.
TAI	international atomic time; unit is the SI second of geoid.
UTC	coordinated universal time; differs from TAI by an integral number of seconds, and is the basis of most radio time signals and national and/ or legal time systems.
ΔUT	= UT1 – UTC; increment to be applied to UTC to give UT1
TDB	barycentric dynamical time; used as time-scale of ephemerides, referred to the barycentre of the solar system.
T_{eph}	the independent variable of the equations of motion used by the JPL ephemerides, in particular DE405/LE405. T_{eph} and TDB may be considered to be equivalent.
TT	terrestrial time; used as time-scale of ephemerides for observations from the Earth's surface (geoid).
TT	= TAI + $32^s.184$.
ΔT	= TT – UT1; increment to be applied to UT1 to give TT.
	= TAI + $32^s.184$ – UT1
ΔAT	= TAI –UT1; increment to be applied to UTC to give TAI; an integral number of seconds.
ΔTT	= TT – UTC = ΔAT + $32^s.184$; increment to be applied to UTC to give TT.
UT1 - UT0	= – (x sin λ + y cosλ) tanϕ/15 where λ and ϕ are usual geodetic longitude and latitude of the place, and x and y are the co-ordinates of the pole with respect to the geodetic system, in arcseconds.
GAST	= GMST + $\varepsilon_\gamma/15$, ε_γ is equation of equinox.

In order to convert the tabulations for 0^h TT to 0^h UT, one may interpolate to $\Delta T\, \delta_{1/2}/h$ where h is the tabular interval and $\delta_{1/2}$ is the first difference of the tabular values.

REDUCTION OF TIME SCALES, 1620-1644
ΔT = ET - UT

Year	ΔT	Year	ΔT	Year	ΔT	Year	ΔT	Year	ΔT
	s		s		s		s		s
1620.0	+ 124	1625.0	+ 102	1630.0	+ 85	1635.0	+ 72	1640.0	+ 62
1621	119	1626	98	1631	82	1636	70	1641	60
1622	115	1627	95	1632	79	1637	67	1642	58
1623	110	1628	91	1633	77	1638	65	1643	57
1624	+ 106	1629	+ 88	1634	+ 74	1639	+ 63	1644	+ 55

EXPLANATION

REDUCTION OF TIME SCALES, 1645-1819

ΔT = ET - UT

Year	ΔT	Year	ΔT	Year	ΔT	Year	ΔT	Year	ΔT
	s		s		s		s		s
1645.0	+ 54	1680.0	+ 16	1715.0	+ 10	1750.0	+ 13	1785.0	+ 17
1646	53	1681	15	1716	10	1751	14	1786	17
1647	51	1682	14	1717	11	1752	14	1787	17
1648	50	1683	14	1718	11	1753	14	1788	17
1649	49	1684	13	1719	11	1754	14	1789	17
1650.0	+ 48	1685.0	+ 12	1720.0	+ 11	1755.0	+ 14	1790.0	+ 17
1651	47	1686	12	1721	11	1756	14	1791	17
1652	46	1687	11	1722	11	1757	14	1792	16
1653	45	1688	11	1723	11	1758	15	1793	16
1654	44	1689	10	1724	11	1759	15	1794	16
1655.0	+ 43	1690.0	+ 10	1725.0	+ 11	1760.0	+ 15	1795.0	+ 16
1656	42	1691	10	1726	11	1761	15	1796	15
1657	41	1692	9	1727	11	1762	15	1797	15
1658	40	1693	9	1728	11	1763	15	1798	14
1659	38	1694	9	1729	11	1764	15	1799	14
1660.0	+ 37	1695.0	+ 9	1730.0	+ 11	1765.0	+ 16	1800.0	+ 13.7
1661	36	1696	9	1731	11	1766	16	1801	13.4
1662	35	1697	9	1732	11	1767	16	1802	13.1
1663	34	1698	9	1733	11	1768	16	1803	12.9
1664	33	1699	9	1734	12	1769	16	1804	12.7
1665.0	+ 32	1700.0	+ 9	1735.0	+ 12	1770.0	+ 16	1805.0	+ 12.6
1666	31	1701	9	1736	12	1771	16	1806	12.5
1667	30	1702	9	1737	12	1772	16	1807	12.5
1668	28	1703	9	1738	12	1773	16	1808	12.5
1669	27	1704	9	1739	12	1774	16	1809	12.5
1670.0	+ 26	1705.0	+ 9	1740.0	+ 12	1775.0	+ 17	1810.0	+ 12.5
1671	25	1706	9	1741	12	1776	17	1811	12.5
1672	24	1707	9	1742	12	1777	17	1812	12.5
1673	23	1708	10	1743	12	1778	17	1813	12.5
1674	22	1709	10	1744	13	1779	17	1814	12.5
1675.0	+ 21	1710.0	+ 10	1745.0	+ 13	1780.0	+ 17	1815.0	+ 12.5
1676	20	1711	10	1746	13	1781	17	1816	12.5
1677	19	1712	10	1747	13	1782	17	1817	12.4
1678	18	1713	10	1748	13	1783	17	1818	12.3
1679	+ 17	1714	+ 10	1749	+ 13	1784	+ 17	1819	+ 12.2

This table is based on an adopted value of $-26''/cy^2$ for the tidal term ($\dot{n}$) in the mean motion of the Moon from the results of analyses of observations of lunar occultations of stars, eclipses of the Sun and transits of Mercury. (see F.R. Stephenson and L.V. Morrison, 1984 *PhD* Trans, R, Soc. London, Ser A, 313, 47-70).

To calculate the values of ΔT for a different value of the tidal term ($\dot{n}'$), add $-0.000\,091\,(\dot{n}' + 26)\,(\text{year} - 1955)^2$ seconds to the tabulated values of ΔT.

EXPLANATION

REDUCTION OF TIME SCALES FROM 1820

1820 - 1939, ΔT = ET − UT.

From 1940, ΔT = TDT - UT.
2018, ΔT = TT - UT.

Year	ΔT	Year	ΔT	Year	ΔT	Year	ΔT	Year	ΔT
	s		s		s		s		s
1820.0	+ 12.0	1860.0	+ 7.88	1900.0	− 2.72	1940.0	+ 24.33	1980.0	+ 50.54
1821	11.7	1861	7.82	1901	1.54	1941	24.83	1981	51.38
1822	11.4	1862	7.54	1902	− 0.02	1942	25.30	1982	52.17
1823	11.1	1863	6.97	1903	+ 1.24	1943	25.70	1983	52.96
1824	10.6	1864	6.40	1904	2.64	1944	26.24	1984	53.79
1825.0	10.2	1865.0	6.02	1905.0	3.86	1945.0	26.77	1985.0	54.34
1826	9.6	1866	5.41	1906	5.37	1946	27.28	1986	54.87
1827	9.1	1867	4.10	1907	6.14	1947	27.78	1987	55.32
1828	8.6	1868	2.92	1908	7.75	1948	28.25	1988	55.82
1829	8.0	1869	1.82	1909	9.13	1949	28.71	1989	56.30
1830.0	+ 7.5	1870.0	+ 1.61	1910.0	+ 10.46	1950.0	+ 29.15	1990.0	+ 56.86
1831	7.0	1871	+ 0.10	1911	11.53	1951	29.57	1991	57.57
1832	6.6	1872	− 1.02	1912	13.36	1952	29.97	1992	58.31
1833	6.3	1873	1.28	1913	14.65	1953	30.36	1993	58.12
1834	6.0	1874	2.69	1914	16.01	1954	30.72	1994	59.98
1835.0	5.8	1875.0	3.24	1915.0	17.20	1955.0	31.07	1995.0	60.78
1836	5.7	1876	3.64	1916	18.24	1956	31.35	1996	61.63
1837	5.6	1877	4.54	1917	19.06	1957	31.68	1997	62.29
1838	5.6	1878	4.71	1918	20.25	1958	32.18	1998	62.97
1839	5.6	1879	5.11	1919	20.95	1959	32.68	1999	63.47
1840.0	+ 5.7	1880.0	− 5.40	1920.0	+ 21.16	1960.0	+ 33.15	2000.0	+ 63.83
1841	5.8	1881	5.42	1921	22.25	1961	33.59	2001	64.09
1842	5.9	1882	5.20	1922	22.41	1962	34.00	2002	64.30
1843	6.1	1883	5.46	1923	23.03	1963	34.47	2003	64.47
1844	6.2	1884	5.46	1924	23.49	1964	35.03	2004	64.57
1845.0	6.3	1885.0	5.79	1925.0	23.62	1965.0	35.73	2005	+ 64.69
1846	6.5	1886	5.63	1926	23.86	1966	36.54	2006	64.85
1847	6.6	1887	5.64	1927	24.49	1967	37.43	2007	65.15
1848	6.8	1888	5.80	1928	24.34	1968	38.29	2008	65.46
1849	6.9	1889	5.66	1929	24.08	1969	39.20	2009	65.78
1850.0	+ 7.1	1890.0	− 5.87	1930.0	+ 24.02	1970.0	+ 40.18	2010	+ 66.07
1851	7.2	1891	6.01	1931	24.00	1971	41.17	2011	66.32
1852	7.3	1892	6.19	1932	23.87	1972	42.23	2012	66.60
1853	7.4	1893	6.64	1933	23.95	1973	43.37	2013	66.91
1854	7.5	1894	6.44	1934	23.86	1974	44.49	2014	67.28
1855.0	7.6	1895.0	6.47	1935.0	23.93	1975.0	45.48	2015	67.64
1 856	7.7	1896	6.09	1936	23.73	1976	46.46	2016	68.10
1857	7.7	1897	5.76	1937	23.92	1977	47.52	2017	68.59
1858	7.8	1898	4.66	1938	23.96	1978	48.53	2018	68.97
1859	7.8	1899	3.74	1939	24.02	1979	49.59		

Extrapolated Values

2019	+ 69.40	2021	+ 70	2023	+ 71
2020	+ 70	2022	+ 71		

EXPLANATION

Difference TAI – UTC = ΔAT

Date	ΔAT s	Date	ΔAT s	Date	ΔAT s	Date	ΔAT s
1972 Jul.1		1979 Jan.1		1990 Jan.1		1999 Jan. 1	
	+ 11.00		+ 18.00		+ 25.00		+ 32.00
1973 Jan.1		1980 Jan.1		1991 Jan.1		2006 Jan. 1	
	+ 12.00		+ 19.00		+ 26.00		+ 33.00
1974 Jan.1		1981 Jul.1		1992 Jul.1		2009 Jan. 1	
	+ 13.00		+ 20.00		+ 27.00		+ 34.00
1975 Jan.1		1982 Jul.1		1993 Jul.1		2012 Jul. 1	
	+ 14.00		+ 21.00		+ 28.00		+ 35.00
1976 Jan.1		1983 Jul.1		1994 Jul.1		2015 Jul. 1	
	+ 15.00		+ 22.00		+ 29.00		+ 36.00
1977 Jan.1		1985 Jul.1		1996 Jan.1		2017 Jan. 1	
	+ 16.00		+ 23.00		+ 30.00		+ 37.00
1978 Jan.1		1988 Jan.1		1997 Jul.1		In critical cases descend	
	+ 17.00		+ 24.00		+ 31.00	ΔET	
1979 Jan.1		1990 Jan.1		1999 Jan.1		= $\Delta AT + 32^s.184$	
						ΔTT	

From 1990 onwards, ΔT is for Jan. 1 0^h UTC.
See page 2 for a summary of the notation for time-scales.

Astronomical Reference System and Reference Frames

A reference system is the complete specification of how a celestial coordinate system is to be formed. Both the origin and the orientation of the fundamental planes (or axes) are defined. A reference system also incorporates a specification of the fundamental models needed to construct the system; that is, the basis for the algorithms used to transform between observable quantities and reference data in the system. A reference frame, on the other hand, consists of a set of identifiable fiducial points on the sky along with their coordinates, which serves as the practical realization of a reference system.

For example, the fundamental plane of an astronomical reference system has conventionally been the extension of the Earth's equatorial plane, at some date, to infinity. Declination is the angular distance north or south of this plane, and right ascension is the angular distance measured eastward along the equator from some defined reference point. This reference point, the right asscension origin, has traditionally been the Equinox: the point at which the Sun, in its yearly circuit of the celestial sphere, crosses the equatorial plane moving from south to north. The Sun's apparent yearly motion lies in the ecliptic, the plane of the Earth's orbit. The equinox, therefore, is a direction in the space along the nodal line defined by the intersection of the ecliptic and equatorial planes; equivalently, on the celestial sphere, the equinox is at one of the two intersections of the great circles representing these planes. Because both of these planes are moving, the coordinate systems that they define must have a date associated with them; such a reference system must therefore be specified as "the equator and equinox of (some date)".

Of course, such a reference system is an idealization, because the theories of motion of the Earth that define how the two planes move are imperfect. In fact, the very definations of these planes are problematic for high precession work. Even if the fundamental planes of a reference system are defined without any reference to the motions of the Earth, there is no way magically to paint them on the celestial sphere at any particular time. Therefore, in practice, we use a specific reference frame - a set of fiducial objects with assigned coordinates - as the practical representation of an astronomical reference system. The scheme is completely analogous to how terrestrial reference systems are established using survey control stations (geodetic reference point) on the Earth's surface.

Most commonly, a reference frame consists of a catalog of precise positions (and motions, if measurable) of stars or extragalactic objects as seen from the solar system barycenter at a specific epoch (now usually "J2000.0", which is 12h TT on January 2000). Each object's instantaneous position, expressed as right ascension and declination, indicates the object's angular distance from the catalog's equator and origin of right ascension. Any two such objects in the catalog (if they are not coicident or antipodal) therefore uniquely orient a spherical coordinate system on the sky - a reference frame.

EXPLANATION

A modern astrometric catalog contains data on a large number of objects (N), so the coordinate system is vastly overdetermined. The quality of the reference frame defined by a catalog depends on the extent to which the coordinates of all possible pairs of objects ($N^2/2$) serve to the identical equator and right ascesion origin, within the expected random errors. Typically, every catalog contains systematic errors, that is, errors in position that are similar for objects that are in the same area of the sky, or are of the same magnitude (flux) or color (spectral index). Systematic errors mean that the reference frame is warped, or is effectively different for different classes of objects. Obviously, minimizing systematic errors when a catalog is constructed is at least as important as minimizing the random errors.

To be useful, a reference frame must be implemented at the time of actual observations, and this requires the computation of the apparent coordinates of the catalog objects at arbitrary dates and times. The accuracy with which we know the motions of the objects accross the sky is an essential factor in this computation. Astrometric star catalogs list proper motions, which are the projection of each star's space motion onto the celestial sphere, expressed as an angular rate in right ascension and declination per unit time. Because the tabulated proper motions are never perfect, any celesial reference frame deteriorates with time. Moreover, systematic errors in the proper motions can produce time-dependent warpings and spurious rotations of the frame. Therefore, the accuracy and consistency of the proper motions are critical to the overall quality, utility, and longevity of reference frames defined by stars. Even reference frames defined by extragalactic objects, which are usually considered to have zero proper motion, may deteriorate, because many of these objects show small apparent motions that are artifacts of their emission mechanisms.

The position of solar system objects can also be used to define a reference frame. For each solar system body involved, an ephemeris is used, which is simply a table of the celestial coordinates of the body as a funtion of time (or an algorithm that yields such a table). A reference frame defined by the ephemerides of one or more solar system bodies is called a dynamical reference frame. Because the ephemerides used incorporate the motion of the Earth as well as that of the other solar system bodies, dynamical reference frames embody in a very fundamental way the moving equator and ecliptic, hence the equinox. They have therefore been used to correct the orientation of star catalog reference frames (the star positions were systematically adjusted) on the basis of simultaneous observations of star and planets. In a sense, the solar system is used as a gyrocompass. However, dynamical reference frames are not very practical for establishing a coordinate system for day to day astronomical observations.

Descriptions of reference frames and reference systems often refer to three coordinate axes, which are simply the set of right-handed cartesian axes that correspond to the usual celestial spherical coordinate system. The xy-plane is the equator, the z-axis points toward the north celestial pole, and the x-axis points toward the origin of right ascension. Although in principal this allows us to specify the position of any celestial object in rectangular coordinates, the distance scale (based on stellar parallaxes) is not established to high precession beyond the solar system. What a reference system actually defines is the way in which the two coventional astronomical angular coordinates, right ascension and declination, overlay real observable points in the sky.

The fundamental celestial reference system for astronomical application is now the International Celestial Reference System (ICRS) as provided in resolution B2 of 1997. The "realization" of of the ICRS, called the International Celestial Reference Frame (ICRF), is a set of high accuracy positions of extragalactic radio sources measured by very long baseline interferometry.

The IAU Working Group on nomenclature for Fundamental Astronomy has recomended the following definations for ICRS and ICRF:

I**nternational Celestial Reference System (ICRS):** The idealized barycetric co-ordinate system to which celestial positions are referred. It is kinematically non-rotating with respect to the ensemble of distant extragalactic objects. It has no intrinsic orientation but was aligned close to the mean equator and dynamical equinox of J2000.0 for continuity with previous fundamental reference systems. Its orientation is independent of epoch, ecliptic or equator and is realized by a list of adopted coordinates of extragalactic sources.

International Celestial Reference Frame (ICRF): A set of extragalactic objects whose adopted positions and uncertainties realize the ICRS axes and give the uncertainties of the axes. It is also the name of radio catalogue whose 212 defining sources are currently the most accurate realization of the ICRS. The orientation of the ICRF catalogue was carried over from earlier IERS radio catalogs and was within the errors of the standard stellar and dynamical frames at the time of adoption. Successive revision of the ICRF are intended to minimize rotation from its original orientation.

EXPLANATION

Some important reference systems and their designations as per IAU 2000 resolution B1.6, B1.7 and B1.8, and IAU 2006 resolutions 1 and 2 are listed below:

(i) Barycentric Celestial Reference System (BCRS): a system of barycentric space-time coordinates for the solar system within the framework of General Relativity. For all practical applications, the BCRS is assumed to be oriented according to the ICRS axes, the directions of which are realized by the International Celestial Reference Frame. The ICRS is not identical to the system defined by the dynamical mean equator and equinox of J2000.0, although the difference in orientation is only about $0''.02$.

(ii) The Geocentric Celestial Reference System (GCRS): is a system of geocentric space-time coordinates within the framework of General Relativity. The directions of the GCRS axes are obtained from those of the BCRS (ICRS) by a relativistic transformation. Positions of stars obtained from ICRS reference data, corrected for proper motion, parallax, light-bending, and aberration (for a geocentric observer) are with respect to the GCRS. The same is true for planetary positions, although the corrections are somewhat different.

(iii) The J2000.0 dynamical reference system: mean equator and equinox of J2000.0; a geocentric system where the origin of right ascension is the intersection of the mean ecliptic and equator of J2000.0; the system in which the IAU 2000 precession-nutation is defined. For precise applications a small rotation (frame bias) should be made to GCRS positions before precession and nutation are applied. The J2000.0 system may also be barycentric, for example as the reference system for catalogues.

(iv) The true system of date (t); true equator and equinox of date: a geocentric system of date, the pole of which is the celestial intermediate pole (CIP), with the origin of right ascension at the equinox on the true equator of date (intermediate equator). It is a system "between" the GCRS and the Terrestrial Intermediate Reference System that seperates the components labelled precession-nutation and polar motion.

(v) The Celestial Intermediate Reference System (i): the IAU recomended geocentric system of date, the pole of which is the celestial intermediate pole (CIP), with the origin of right ascension at the celestial intermediate origin (CIO) which is located on the intermediate equator (true equator of date). It is a system "between" (intermeiate) the GCRS and the Terrestrial Intermediate Reference System that seperates the components labelled precession-nutation and polar motion.

Precession and Nutation

The algorithms for precession were based on the IAU (1976) value for the rate of general precession in ecliptic longitude. Nutation was given by the 1980 IAU Theory of Nutation. However, IAU (1976) rate of precession had been overestimated by approximately 3 milliarcseconds per year. Further observations also revealed periodic errors of a few milliarcseconds in the 1980 IAU Theory of Nutation.

As part of the 2000 IAU resolutions, the IAU 2000A precession-nutation model was introduced, based on an updated value for the rate of precession and a completely new nutation theory. As before, the model actually consists of two parts, a precession algorithm describing the smooth secular motion of the celestial pole and a nutation algorithm describing the small periodic variations in the pole's position. The precession algorithm consists of short polynomial series for the values of certain angles. The sines and cosines of these angles, in combination, then define the elements of a precession matrix, **P**. The nutation algorithm consists of a rather long series expansion in Fourier terms for the angular offsets, in ecliptic longitude and latitude, of the actual celestial pole (as modeled) from the precession-only pole (true pole - mean pole). The sines and cosines of these offsets, in combination, then define the elements of a nutation matrix, **N.** The **P** and **N** matrices are applied to the coordinates of celestial objects, expressed as 3-vectors, to transform them from the equator and equinox of one epoch to the equator and equinox of another.

EXPLANATION

A precession transformation is applied to celestial coordinates to convert them from the mean equator and equinox of J2000.0 to the mean equator and equinox of another date, t. Nutation is applied to the resulting coordinates to transform them to the true equator and equinox of t. Generally we will start with celestial coordinates in the GCRS, which are obtained from basic ICRS data by applying the usual algoriths for proper place. Therefore before we apply precession and nutation - we must first apply the frame bias correction to transform the GCRS coordinates to the dynamical mean equator and equinox of J2000.0. Schematically,

GCRS => frame bias = mean equator & equinox of J2000.0 = precession =>

mean equator & equinox of t = nutation => true equator & equinox of t.

The reduction from a geocentric position **r** with respect to the Geocentric Celestial Reference System (GCRS) to a position $\mathbf{r}_t$ with respect to equator and equinox of date, and vice versa, is given by;

$$\mathbf{r}_t = \mathbf{M}\,\mathbf{r} \quad \text{and } \mathbf{r} = \mathbf{M}^{-1}\mathbf{r}_t$$

Using the 4-rotation Fukishma-Williams (F-W) method, the rotation matrix **M** may be witten as

$$\mathbf{M} = \mathbf{N\,P\,B}$$

Since the rotation to orient the GCRS to J2000.0 system are small the following approximate matrix **B** is called frame bias matrix, accurate to 2"x 10^{-9} (1 x 10^{-14} radians), may be used:

$$\mathbf{B} = \begin{bmatrix} 1 & d\alpha_0 & -\xi_0 \\ -d\alpha_0 & 1 & -\eta_0 \\ \xi_0 & \eta_0 & 1 \end{bmatrix}$$

where $d\alpha_0$ = -14.6 mas, ξ_0 = -16.6170 mas, and η_0 = -6.8192 mas, all converted to radians (divide by 206 264 806.247).

Precession

The time argument T is given by

$$T = (t - 2000.0)/100 = (JD_{TT} - 2451545.0)/36525, \text{ which is a function of TT.}$$

The Capitine *et al.* method, the formulation of which seperates precession of the equator from precession of the ecliptic, is via the precession angles χ_A, ω_A, ψ_A, which are

$$\psi_A = 5038''.481\,507\,T - 1''.079\,0069\,T^2 - 0''.001\,140\,45\,T^3 + 0''.000\,132\,851\,T^4 - 9''.51 \text{ X } 10^{-8}\,T^5$$

$$\omega_A = \varepsilon_0 - 0''.025\,754\,T + 0''.051\,2623\,T^2 - 0''.007\,725\,03\,T^3 - 0''.000\,000\,467\,T^4 + 33''.37 \text{ X } 10^{-8}\,T^5$$

$$\chi_A = 10''.556\,403\,T - 2''.381\,4292\,T^2 - 0''.001\,211\,97\,T^3 + 0''.000\,170\,663\,T^4 - 5''.60 \text{ X } 10\text{-}8\,T^5$$

The mean obliquity of the ecliptic at J2000.0 (or the equivalent TDB date) is ε_0 = 84381".406

(i) A rotation from the mean equator and equinox of J2000.0 to the mean ecliptic and equinox of J2000.0. This is simply a rotation around the x-axis (the direction toward the mean equinox of J2000.0) by the angle ε_0, the mean obliquity of J2000.0. After the rotation, the fundamental plane is the ecliptic of J2000.0

(ii) A rotation around the new z-axis (the direction toward the ecliptic pole of J2000.0) by the angle $-\psi_A$, the amount of precession of the equator from J2000.0 to t.

(iii) A rotation around the new x-axis (the direction along the intersection of the mean equator of t with the ecliptic of J2000.0) by the angle - ω_A, the obliquity of the mean equator of t with respect to the ecliptic of J2000.0. After the rotation, the fundamental plane is the mean equator of t.

EXPLANATION

(iv) A rotation around the new z-axis (the direction toward the mean celestial pole of t) by the angle χ_A, accounting for the precession of the ecliptic along the mean equator of t. After the rotation, the new x-axis is in the direction of the mean equinox of date.

$$\mathbf{P} = \begin{bmatrix} C_4C_2 - S_2S_4C_3 & C_4S_2C_1 + S_4C_3C_2C_1 - S_1S_4S_3 & C_4S_2S_1 + S_4C_3C_2S_1 + C_1S_4S_3 \\ -S_4C_2 - S_2C_4C_3 & -S_4S_2C_1 + C_4C_3C_2C_1 - S_1C_4S_3 & -S_4S_2S_1 + C_4C_3C_2S_1 + C_1C_4S_3 \\ S_2S_3 & -S_3C_2C_1 - S_1C_3 & -S_3C_2S_1 + C_3C_1 \end{bmatrix}$$

where $S_1 = \sin \varepsilon_0$ $S_2 = \sin(-\psi_A)$ $S_3 = \sin(-\omega_A)$ $S_4 = \sin \chi_A$
$C_1 = \cos \varepsilon_0$ $C_2 = \cos(-\psi_A)$ $C_3 = \cos(-\omega_A)$ $C_4 = \cos \chi_A$

Existing applications that use the 3-angle precession formulation of Newcomb and Lieske can be easily modified for the IAU 2000A precession, by replacing the current polynomials for the angles ζ_A, Z_A and θ_A with the following:

$$\zeta_A = 2''.650545 + 2306''.083227\,T + 0''.2988499\,T^2 + 0''.01801828\,T^3 - 0''.000005971\,T^4 - 0''.0000003173\,T^5$$

$$Z_A = -2''.650545 + 2306''.077181\,T + 1''.0927348\,T^2 + 0''.01826837\,T^3 - 0''.000028596\,T^4 - 0''.0000002904\,T^5$$

$$\theta_A = 2004''.191903\,T - 0''.4294934\,T^2 - 0''.04182264\,T^3 - 0''.000007089\,T^4 - 0''.0000001274\,T^5$$

The centennial (per Julian century) rates of general precession in right ascension and declination are given by :

$$m = 4612''.604\,08 + 2''.783\,169\,4\,T + 0''.108\,859\,95\,T^2 - 0''.000\,138\,268\,T^3 \text{ and}$$

$$n = 2004''.191\,903 - 0''.858\,986\,8\,T - 0''.125\,467\,92\,T^2 - 0''.000\,028\,356\,T^3$$

The elements of the matrix **P** given in terms of ζ_A, Z_A, θ_A are as follows:

$$\mathbf{P} = \begin{bmatrix} \cos\zeta_A \cos\theta_A \cos Z_A - \sin\zeta_A \sin Z_A & -\sin\zeta_A \cos\theta_A \cos Z_A - \cos\zeta_A \sin Z_A & -\sin\theta_A \cos Z_A \\ \cos\zeta_A \cos\theta_A \sin Z_A + \sin\zeta_A \cos Z_A & -\sin\zeta_A \cos\theta_A \sin Z_A + \cos\zeta_A \cos Z_A & -\sin\theta_A \sin Z_A \\ \cos\zeta_A \sin\theta_A & -\sin\zeta_A \sin\theta_A & \cos\theta_A \end{bmatrix}$$

The formula for reduction of precession in right ascension and declination are as follows :

$$\begin{aligned} \sin(\alpha - Z_A)\cos\delta &= \sin(\alpha_o + \zeta_A)\cos\delta_o. \\ \cos(\alpha - Z_A)\cos\delta &= \cos(\alpha_o + \zeta_A)\cos\theta_A \cos\delta_o - \sin\theta_A \sin\delta_o \\ \sin\delta &= \cos(\alpha_o + \zeta_A)\sin\theta_A \cos\delta_o + \cos\theta_A \sin\delta_o \end{aligned}$$

$$\begin{aligned} \sin(\alpha_o + \zeta_A)\cos\delta_o &= \sin(\alpha - Z_A)\cos\delta \\ \cos(\alpha_o + \zeta_A)\cos\delta_o &= \cos(\alpha - Z_A)\cos\theta_A \cos\delta + \sin\theta_A \sin\delta \\ \sin\delta_o &= -\cos(\alpha - Z_A)\sin\theta_A \cos\delta + \cos\theta_A \sin\delta \end{aligned}$$

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Values of the angles ζ_A, Z_A, θ_A and of the elements of the matrix P for reduction from the standard epoch J 2000.0 to epoch of year are as follows:

Epoch J 2020.5 — Rotation matrix P for reduction to epoch J 2020.5

$$\zeta_A = +475''.410 = +0^\circ.132\,058$$
$$Z_A = +470''.141 = +0^\circ.130\,595 \qquad \mathbf{P} = \begin{bmatrix} +0.999\,987\,51 & -0.004\,584\,14 & -0.001\,991\,81 \\ +0.004\,584\,14 & +0.999\,989\,49 & -0.000\,004\,54 \\ +0.001\,991\,81 & -0.000\,004\,59 & +0.999\,998\,02 \end{bmatrix}$$
$$\theta_A = +410''.841 = +0^\circ.114\,122$$

The obliquity of the ecliptic of date (with respect to the mean equator of date) is given by:

$$\varepsilon = \varepsilon_0 - 46''.836\,769T - 0''.000\,183\,1\,T^2 + 0''.002\,003\,4\,T^3 - 0''.000\,000\,576\,T^4 - 0''.000\,000\,043\,4\,T^5$$

where $\varepsilon_0 = 84381''.406$

The precessional motion of the ecliptic specified by the inclination (π_A) and longitude of the node (Π_A) of the ecliptic of date with respect to the ecliptic and equinox of J 2000.0 are given by:

$$\text{Sin}\,\pi_A \sin\Pi_A = +4''.199\,094\,T + 0''.193\,987\,T^2 - 0''.000\,224\,66\,T^3$$
$$\text{Sin}\,\pi_A \cos\Pi_A = -46''.811\,015\,T + 0''.051\,028\,T^2 + 0''.000\,524\,13\,T^3$$

For epoch J 2020.5

$$\varepsilon = 23^\circ\,26'\,11''.80 = 23^\circ.436\,612$$
$$\pi_A = +9''.633 = 0^\circ.002\,675\,9$$
$$\Pi_A = 174^\circ\,49'.5 = 174^\circ.825$$

Approximate formulae for the reduction of precession in co-ordinates and orbital elements referred to the mean equinox and equator or ecliptic of date (t) are as follows :

Reduction to J 2000.0	Reduction from J 2000.0
$\alpha_o = \alpha - M - N\sin\alpha_m \tan\delta_m$	$\alpha = \alpha_o + M + N\sin\alpha_m \tan\delta_m$
$\delta_o = \delta - N\cos\alpha_m$	$\delta = \delta_o + N\cos\alpha_m$
$\lambda_o = \lambda - a + b\cos(\lambda + c')\tan\beta_o$	$\lambda = \lambda_o + a - b\cos(\lambda_o + c)\tan\beta$
$\beta_o = \beta - b\sin(\lambda + c')$	$\beta = \beta_o + b\sin(\lambda_o + c)$
$\Omega_o = \Omega - a + b\sin(\Omega + c')\cot i_o.$	$\Omega = \Omega_o + a - b\sin(\Omega_o + c)\cot i$
$i_o = i - b\cos(\Omega + c')$	$i = i_o + b\cos(\Omega_o + c)$
$\omega_o = \omega - b\sin(\Omega + c')\,\text{cosec}\, i_o$	$\omega = \omega_o + b\sin(\Omega_o + c)\,\text{cosec}\, i$

The precessional constants M, N etc. are given by :

$$M = 1^\circ.281\,155\,668\,9\,T + 0^\circ.000\,386\,551\,31\,T^2 + 0^\circ.000\,010\,079\,T^3$$
$$N = 0^\circ.556\,719\,973\,1\,T - 0^\circ.000\,119\,303\,72\,T^2 - 0^\circ.000\,011\,617\,4\,T^3$$
$$a = 1^\circ.396\,887\,83\,T + 0^\circ.000\,307\,065\,22\,T^2$$
$$b = 0^\circ.013\,055\,270\,3\,T - 0^\circ.000\,009\,303\,50\,T^2$$
$$c = 5^\circ.125\,890\,67 + 0^\circ.818\,993\,58\,T + 0^\circ.000\,104\,256\,09\,T^2 - 0^\circ.000\,104\,155\,607\,T^3$$
$$c' = 5^\circ.125\,890\,67 - 0^\circ.577\,894\,252\,T - 0^\circ.000\,164\,504\,28\,T^2 - 0^\circ.000\,104\,177\,728\,T^3$$

where $T = (t - 2000.0)/\,100 = (JD_{TT} - 245\,1545.0)/\,36525$

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Formulae for the reduction from the mean equinox and equator or ecliptic of the middle of year (t_1) to date (t) are as follows :

$$\alpha = \alpha_1 + \tau\,(m + n \sin \alpha_1 \tan \delta_1) \qquad \delta = \delta_1 + \tau\, n \cos \alpha_1$$
$$\lambda = \lambda_1 + \tau\,\{p - \pi \cos(\lambda_1 + 6^\circ) \tan \beta\} \qquad \beta = \beta_1 + \tau\,\pi \sin(\lambda_1 + 6^\circ)$$
$$\Omega = \Omega_1 + \tau\,\{\rho - \pi \sin(\Omega_1 + 6^\circ) \cot i\} \qquad i = i_1 + \tau\,\pi \cos(\Omega_1 + 6^\circ)$$
$$\omega = \omega_1 + \tau\,\pi \sin(\Omega_1 + 6^\circ)\ \mathrm{cosec}\ i$$

where $\tau = t - t_1$ and π is the annual rate of rotation of the ecliptic. The precessional constants p, m, etc. are as follows :

		Epoch J 2020.5
Annual general precession	p =	$+ 0^\circ.013\,970\,98$
Annual precession in R.A.	m =	$+ 0^\circ.012\,813\,91$
Annual precession in Dec.	n =	$+ 0^\circ.005\,567\,04$
Annual rate of rotation	π =	$+ 0^\circ.000\,130\,53$
Longitude of axis	Π =	$+ 175^\circ.0637$

$$\gamma = 180^\circ - \Pi = + 4^\circ.9363$$

Where Π is the longitude of the instantaneous rotation axis of the ecliptic, measured from the mean equinox of date.

Nutation

The changes in the amplitudes of the nutation components are also not directly taken from the observations; instead a new nutation theory is developed and fit to observations by allowing a small number of geophysical constants to be free parameters. These parameters are constants in a “transfer function” that modifies the amplitudes of the terms from a rigid- Earth nutation development. Since there are fewer solved-for geophysical constants than the number of terms with observed amplitudes, the fit cannot be perfect. For the IAU 2000A model, 7 geophysical parameters were determined based on the observed amplitudes of 21 nutation terms (prograde and retrograde amplitudes for each) together with the apparent change in the rate of precession in longitude. Note that the number of free parameters in the model are both quite small compared to the 1365 terms in the new, full nutation serirs.

Nutation is conventionally expressed as two small angles, $\Delta\psi$ the nutation in longitude, and $\Delta\varepsilon$, the nutation in obliquity. These angles are measured in the Ecliptic system of date, which is developed as a part of precession formulation. The angle $\Delta\psi$ is the small change in the position of the equinox along the ecliptic due to nutation, so effect of nutation on the ecliptic coordinates of a fixed point in the sky is simply to add $\Delta\psi$ to its ecliptic longitude. The angle $\Delta\varepsilon$ is the small change in the obliquity of the ecliptic due to nutation. The true obliquity of date is $\varepsilon' = \varepsilon + \Delta\varepsilon$. Nutation in obliquity reflects the orientation of the equator in space and does not affect the ecliptic coordinates of a fixed point on the sky.

Formulas for Nutation

l	is the mean anomaly of the Moon.
l'	is the mean anomaly of the Sun (Earth).
Ω	is the longitude of the ascending node of the Moon’s mean orbit on the ecliptic, measured from the mean equinox of date.
D	is the mean elongation of the Moon from the Sun.
F	is the difference $L - \Omega$, where L is the mean longitude of the Moon.
ε	$= \varepsilon_0 - 46''.836\,769\,T - 0''.000\,183\,1\,T^2 + 0''.002\,003\,4\,T^3 - 0''.000\,000\,576\,T^4 - 0''.000\,000\,043\,4\,T^5$

where $\varepsilon_0 = 84381''.406$

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The fundamental arguments are given by:

The five arguments are the same fundamental luni - solar arguments used in previous nutation theories, but with updated expressions.

l = $485\,868''.249\,036 + (1325^r + 715\,923''.2178)\,T + 31''.8792\,T^2 + 0''.051\,635\,T^3 - 0''.000\,244\,70\,T^4$

l' = $128\,7104''.793\,04 + (99^r + 129\,2581''.048)\,T - 0''.5532\,T^2 - 0''.000\,136\,T^3 - 0''.000\,011\,49\,T^4$

F = $335\,779''.526\,232 + (1342^r + 295\,262''.8478)\,T - 12''.7512\,T^2 - 0''.001\,037\,T^3 + 0''.000\,004\,17\,T^4$

D = $107\,2260''.703\,69 + (1236^r + 110\,5601''.209)\,T - 6''.3706\,T^2 + 0''.006\,593\,T^3 - 0''.000\,031\,69\,T^4$

Ω = $450\,160''.398\,036 - (5^r + 482\,890''.5431)\,T + 7''.722\,T^2 + 0''.007\,702\,T^3 - 0''.000\,059\,39\,T^4$

where $1^r = 360^o = 129\,6000''$

Reduction for nutation - rigorous formulae

Nutation in longitude ($\Delta\psi$) and obliquity ($\Delta\varepsilon$) have been calculated using IAU 2000A series definitions (order of 1 µas) with the following adjustments which are required for use at the highest precession with the IAU 2006 precession, viz:

$$\Delta\psi = \Delta\psi_{2000A} + (0.4697 \times 10^{-6} - 2.7774 \times 10^{-6} T)\,\Delta\psi_{2000A}$$

$$\Delta\varepsilon = \Delta\varepsilon_{2000A} - 2.7774 \times 10^{-6}\,T\,\Delta\varepsilon_{2000A}$$

where T is measured in Julian centuries from 245 1545.0 TT. $\Delta\psi$ and $\Delta\varepsilon$ together with the true obliquity of the ecliptic (ε') are tabulated daily at 0^h TT, on page 18 to 32.

Once the nutation series has been evaluated and the values of $\Delta\psi$ and $\Delta\varepsilon$ are available, the nutation matrix can be constructed.

A mean place ($\mathbf{r}_m$) may be transformed to a true place ($\mathbf{r}_t$) and vice versa, as follows:

$$\mathbf{r}_t = \mathbf{N}\,\mathbf{r}_m \qquad \mathbf{r}_m = N^{-1}\,\mathbf{r}_t$$

where $\mathbf{N} = \mathbf{R}_1(-\varepsilon')\,\mathbf{R}_3(-\Delta\psi)\,\mathbf{R}_1(+\varepsilon)$

$\varepsilon' = \varepsilon + \Delta\varepsilon$

$\mathbf{R}_1$ and $\mathbf{R}_3$ are the standard rotations about the x and z axes respectively.

(i) A rotation from the mean equator and equinox of t to the mean ecliptic and equinox of t. This is simply a rotation around the x - axis (the direction toward the mean equinox of t) by the angle ε, the mean obliquity of t.

(ii) A rotation around the new z-axis (the direction toward the ecliptic pole of t) by the angle $-\Delta\psi$, the amount of nutation in longitude at t. After the rotation, the new x- axis is in the direction of true equinox of t.

(iii) A rotation around the new x-axis (the direction toward true equinox of t by the angle $-\varepsilon'$, the true oliquity of t. After the rotation, the fundamental plane is the true equator of t, orthogonal to the computed position of the CIP at t.

The nutation matrix can be written:

$$\mathbf{N} = \begin{bmatrix} C_2 & S_2C_1 & S_2S_1 \\ -S_2C_3 & C_3C_2C_1 - S_1S_3 & C_3C_2S_1 + C_1S_3 \\ S_2S_3 & -S_3C_2C_1 - S_1C_3 & -S_3C_2S_1 + C_3C_1 \end{bmatrix}$$

where $S_1 = \sin(\varepsilon)$ $\quad S_2 = \sin(-\Delta\psi)$ $\quad S_3 = \sin(-\varepsilon - \Delta\varepsilon)$

$C_1 = \cos(\varepsilon)$ $\quad C_2 = \cos(-\Delta\psi)$ $\quad C_3 = \cos(-\varepsilon - \Delta\varepsilon)$

Approximate reduction for nutation for converting mean place to true place can be done with the help of the following formualae :

$$\Delta\alpha = (\cos\varepsilon + \sin\varepsilon\,\sin\alpha\,\tan\delta)\,\Delta\psi - \cos\alpha\,\tan\delta\,\Delta\varepsilon$$

$$\Delta\delta = \sin\varepsilon\,\cos\alpha\,\Delta\psi + \sin\alpha\,\Delta\varepsilon$$

$$\Delta\lambda = \Delta\psi; \qquad \Delta\beta = 0$$

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where $\Delta\psi$ and $\Delta\varepsilon$ are nutations in longitude and obliquity respectively. Mean rectangular coordinates (x, y, z) can be converted to true rectangular co-ordinates with the help of the following :

$$\Delta x = -(y \cos \varepsilon + z \sin \varepsilon)\, \Delta\psi$$
$$\Delta y = +x\, \Delta\psi \cos \varepsilon - z\, \Delta\varepsilon$$
$$\Delta z = +x\, \Delta\psi \sin \varepsilon + y\, \Delta\varepsilon$$

where both $\Delta\psi$ and $\Delta\varepsilon$ are in radians.

The elements of the corresponding rotation matrix are:

$$\mathbf{N} = \begin{bmatrix} 1 & -\Delta\psi \cos \varepsilon & -\Delta\psi \sin \varepsilon \\ +\Delta\psi \cos \varepsilon & 1 & -\Delta\varepsilon \\ +\Delta\psi \sin \varepsilon & +\Delta\varepsilon & 1 \end{bmatrix}$$

Daily values of $\Delta\psi$ and $\Delta\varepsilon$ during 2020 are tabulated on pages 18 to 32.

Approximate reduction for precession and nutation in right ascension and declination from the standard equinox and equator of J 2000.0 to the true equinox and equator of date during 2020 can be done using the following formulae and table :

$$\alpha = \alpha_o + f + g \sin (G + \alpha_o) \tan \delta_o$$
$$\delta = \delta_o + g \cos (G + \alpha_o)$$

where the units of the correction to α_o and δ_o are in second of time and minutes of arc respectively.

Date 2020		*f* s	*g* s	*g* ′	*G* h	m	Date 2020		*f* s	*g* s	*g* ′	*G* h	m
Jan.	**- 8 ***	+ 60.4	26.2	6.56	00	02	**Jun.**	**30**	+ 62.0	26.9	6.73	00	01
	2	+ 60.5	26.3	6.57	00	01	**Jul.**	**10 ***	+ 62.1	27.0	6.75	00	01
	12	+ 60.6	26.3	6.58	00	01		**20**	+ 62.2	27.0	6.76	00	00
	22	+ 60.7	26.4	6.59	00	01		**30**	+ 62.3	27.1	6.77	00	00
Feb.	**1 ***	+ 60.8	26.4	6.60	00	01	**Aug.**	**9**	+ 62.4	27.1	6.78	00	00
	11	+ 60.9	26.5	6.61	00	01		**19 ***	+ 62.5	27.1	6.79	00	00
	21	+ 61.0	26.5	6.62	00	01		**29**	+ 62.5	27.2	6.79	00	00
Mar.	**2**	+ 61.0	26.5	6.63	00	01	**Sep.**	**8**	+ 62.6	27.2	6.80	00	00
	12 *	+ 61.1	26.5	6.63	00	01		**18**	+ 62.6	27.2	6.81	00	00
	22	+ 61.1	26.6	6.64	00	00		**28 ***	+ 62.7	27.3	6.81	00	00
Apr.	**1**	+ 61.2	26.6	6.65	00	01	**Oct.**	**8**	+ 62.8	27.3	6.82	00	00
	11	+ 61.2	26.6	6.65	00	01		**18**	+ 62.8	27.3	6.82	00	00
	21 *	+ 61.3	26.6	6.66	00	00		**28**	+ 62.9	27.3	6.83	00	00
May.	**1**	+ 61.4	26.7	6.67	00	01	**Nov.**	**7 ***	+ 63.0	27.4	6.84	00	00
	11	+ 61.5	26.7	6.68	00	01		**17**	+ 63.1	27.4	6.85	00	00
	21	+ 61.6	26.7	6.69	00	01		**27**	+ 63.2	27.4	6.86	00	00
	31 *	+ 61.7	26.8	6.70	00	01	**Dec.**	**7**	+ 63.3	27.5	6.88	00	00
Jun.	**10**	+ 61.8	26.8	6.71	00	01		**17 * †**	+ 63.4	27.6	6.89	00	00
	20	+ 61.9	26.9	6.72	00	01		**27**	+ 63.5	27.6	6.90	00	00
	30	+ 62.0	26.9	6.73	00	01		**37**	+ 63.6	27.6	6.91	00	00

* 40 - day date   † 400 day date for osculation epoch

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Differential Precession and Nutation can be applied to obtain the differences in the mean place of an object relative to a comparison star for a standard epoch (J 2000.0) using the following formulae:

correction to R.A. : $e \tan \delta \Delta\alpha - f \sec^2 \delta \Delta\delta$

correction to declination : $f \Delta\alpha$

where $\Delta\alpha$ and $\Delta\delta$ are the observed differences in right ascension and declination of the object relative to the comparison star and

$e = -\cos\alpha\,(n\,t + \sin\varepsilon\,\Delta\psi) - \sin\alpha\,\Delta\varepsilon$

$f = +\sin\alpha\,(n\,t + \sin\varepsilon\,\Delta\psi) - \cos\alpha\,\Delta\varepsilon$

$\varepsilon = 23^\circ.44, \ \sin\varepsilon = 0.398$

$n = 0.000\,0972$ radian for epoch J 2020.5

t is the time in years from the standard epoch to the time of observation.

$\Delta\psi$, $\Delta\varepsilon$ are nutations in longitude and obliquity at the time of observation expressed in radians, (1" = 0.000 004 8481 rad).

Aberration

Aberration is the displacement of the position of a celestial object due to finite speed of light. The actual velocity of light in space c is the vectorial sum of its velocity relative to the observer c_r and the velocity V of the observer. Although the special theory of relativity has no provision of breaking up aberration of light into components, total effects of aberration in astronomy are broken into stellar, annual, elliptic, secular and planetary aberration for convenience of computation. In case of stars, all that can be determined is the displacement in their positions caused by the motion of the observer alone. It is calculated on the basis of the actual instantaneous motion of the Earth round the barycentre of the solar system.

Earlier, the practice was to resolve the stellar aberration into two components; one contributed by the circular motion of the Earth moving with a constant mean velocity round the Sun, and the other, a nearly constant displacement perpendicular to the major axis of the orbit arising due to ellipticity of the orbit of the Earth. The latter, known as the E-terms of aberration was included in the mean position of the stars as given in star catalogues and was omitted in the computation of day numbers. As a result, the mean places of stars differed from the catalogue mean places. This procedure was adopted to minimise the computation work for the user of star catalogues. However, this practice has caused much confusion lately because the accurate total velocity of the Earth referred to the barycentre of the solar system could not be used in computing stellar aberration. In accordance with a decision of the IAU in 1976, this occasion has been used to simplify this procedure by removing the E terms of aberration from the mean places and to include them in the reduction from mean to apparent place so that the apparent places remain unchanged. Thus, the mean places of FK5 are free from E terms. In other words, they will be the positions of the stars at epoch J 2000.0 as viewed from the barycentre of the solar system, in the co-ordinate system defined by the Earth's mean equator and equinox of J 2000.0.

The conversion of 1950.0 star catalogue positions (α,δ) to actual mean places ($\alpha+\Delta\alpha$, $\delta+\Delta\delta$) can be accomplished by :

$$\Delta\alpha = 0^{s}.\,0227 \sin(\alpha + 11^{h}.\,25) \sec\delta$$

$$\Delta\delta = 0''.341 \cos(\alpha + 11^{h}.\,25) \sin\delta + 0''.029 \cos\delta$$

For solar system objects, the displacement of the light source during the time (Δt) taken by light to travel from it to the Earth combined with the effect of relative motion of the Earth and the light is known as planetary aberration. Its computation requires a knowledge of the distance and motion of the light source and can be accomplished as follows. First, the barycentric position of the body at time $t-\Delta t$ is combined with the barycentric position of the Earth at time t and then the correction for annual aberration is applied. Planetary aberration may also be

EXPLANATION

computed by interpolating the geometric (geocentric) ephemeris of the body to the time t - Δt. The light time Δt is given by:

$$\Delta t \text{ (in days)} = 0.005\,7755 \text{ x distance in a.u.}$$

Annual aberration for reduction from a geometric place (α_0, δ_o) to an apparent geocentric place (α, δ) is given by :

$$\alpha = \alpha_0 + (-\dot{X} \sin \alpha_0 + \dot{Y} \cos \alpha_0) / (c \cos \delta_0)$$

$\delta = \delta_0 + (-\dot{X} \cos \alpha_0 \sin \delta_0 - \dot{Y} \sin \alpha_0 \sin \delta_0 + \dot{Z} \cos \delta_0)/ c$, where c = 173.14 a.u./day and $\dot{X}, \dot{Y}, \dot{Z}$ are the velocity components of the Earth (pages 256 to 270).

The reduction of observations of the radial velocity to a common origin at the barycentre is given by adding the component of the Earth's velocity in the direction (α_0, δ_0) of the object :

$$\dot{X} \cos \alpha_0 \cos \delta_0 + \dot{Y} \sin \alpha_0 \cos \delta_0 + \dot{Z} \sin \delta_0$$

Differential annual aberration corrections to be added to the observed differences of right ascension and declination (in the sense moving object minus star) to give true differences are:

(R.A.) a $\Delta\alpha + b\,\Delta\delta$ (in units of $0^s.001$) ; (declination) c $\Delta\alpha + d\,\Delta\delta$ (in units of $0''.01$)

Here $\Delta\alpha$ is to be taken in units of 1^m and $\Delta\delta$ in units of 1'. The coefficients a, b, c and d are defined by:

$a = -5.701 \cos (H+\alpha) \sec \delta$

$b = -0.380 \sin (H+\alpha) \sec \delta \tan \delta$

$c = +8.552 \sin (H+\alpha) \sin \delta$

$d = -0.570 \cos (H+\alpha) \cos \delta$

$H^h = 23.4 - (\text{day of year}/15.2)$

(The day of year is tabulated on pages 4 to 12)

Annual parallax correction can be calculated approximately for reduction from the catalogue place (α_0,δ_0) to the geocentric place (α,δ) using the following formulae;

$\alpha = \alpha_0 + (\pi / 15 \cos \delta_0)(X \sin \alpha_0 - Y \cos \alpha_0)$ and $\delta = \delta_0 + \pi(X \cos \alpha_0 \sin \delta_0 + Y \sin \alpha_0 \sin \delta_0 - Z \cos \delta_0)$

where π is the annual parallax and X, Y, Z, are the coordinates of the Earth as given on pages 256 to 270.

Deflection of light in the gravitational field of the Sun may significantly affect the apparent direction of a star or of a body in the solar system. The elongation (E) from the centre of the Sun is increased by an amount that, for a star, depends on the elongation in the following manner:

$$\Delta E = 0''.004\,07 / \tan (E/2)$$

E	0°.25	0°.5	1°	2°	5°	10°	20°	50°	90°
ΔE	1".866	0".933	0".466	0".233	0".093	0".047	0".023	0".009	0".004

The body disappears behind the Sun when E is less than the limmiting grazing value of about 8°.25. The effects in right ascension and declination may be calculated approximately from;

$\cos E = \sin \delta \sin \delta_0 + \cos \delta \cos \delta_0 \cos (\alpha - \alpha_0)$

$\Delta\alpha = 0^s.000\,271 \cos\delta_0 \sin (\alpha-\alpha_0)/ (1-\cos E) \cos \delta$

$\Delta\delta = 0''.004\,07 [(\sin \delta \cos \delta_0 \cos (\alpha-\alpha_0) - \cos \delta \sin \delta_0]/ (1- \cos E)$

where α, δ refer to the star, and α_0, δ_0 to the Sun.

EXPLANATION

TABULAR DATA

PART-I -TIME SCALES AND EPHEMERIDES

Dates of year beginning in 2020 of various Indian and important foreign chronological eras are listed on page 3 followed by Gregorian calendar for the current year (pages 4 to 12). The calendar contains, besides the usual information, a count of Julian Day (JD) number for each date. The system of Julian day numbers maintains a continuous count of astronomical days, beginning with JD = 0 on 1 January 4713 B.C., Julian proleptic calendar. Julian Day numbers for other years can be found from the table on page 359. Various time scales used in this publication, their inter -relationships (as given on page 2) and the basis for computation of sidereal time as tabulated on pages 13 to 16; have been discussed above under the section on time scales. The concept of equation of time defined as the difference between local apparent solar time and local mean solar time (in the sense apparent minus mean) is no longer used in astronomy and therefore, it is no more tabulated in this publication. It can, however, be obtained to a precision of about 1 second using the following relation :

Equation of time at 12^h U.T. = 12^h – tabulated value of TT of Sun's ephemeris transit (pages 19 to 33).

In this publication, the ephemeridies of the Sun and planets were reported earlier based on computation jointly made by USNO and JPL by simultaneous numerical integration designated as DE 200/ LE 200. A more recent JPL ephemeris, DE 405/ LE 405 has now come into widespread use, provide barycentric equatorial rectangular coordinates for the period 1600 to 2201. The reference frame for basic ephemerides is the ICRF; the alignment onto this frame has an estimated accuracy of 1 - 2 arcseconds. The JPL DE 405/ LE 405 ephemerides have been developed in a barycentric reference system using a barycentric coordinate time scale $T_{eph.}$. The present edition use the DE 405/ LE 405 ephemeridies data on the positions of the Sun, Moon and planets. The value of some astronomical constants based on previously used DE200/ LE200 ephemeridies and currently used DE 405/ LE 405 ephemerides are given below.

Constant	DE 405 Value	DE 200/ LE 200 Value
Light-time for unit distance, τ_A	499.004 783 84 s	499.004 7837………..s
Geocentric gravitational constant, GE	3.986 004 418 x $10^{14} m^3 s^{-2}$	3.986 004 48……x $10^{14} m^3 s^{-2}$
Heliocentric gravitational constant, GS	1.327 124 42 099 x $10^{20} m^3 s^{-2}$	1.327 124 40……x $10^{20} m^3 s^{-2}$
Ratio of mass of Sun to that of Earth, (GS)/ (GE)	332 946.0 487	332 946.038……….
Ratio of mass of Moon to that of Earth, μ	0.012 300 0371	0.012 300 034
Obliquity of the ecliptic at J2000.0, ε	23° 26′ 21″.406	23° 26′ 21″.4119….
Unit distance, A	1.495 978 707 x 10^{11} m	1.495 978 7066 x 10^{11} m
Ratio of mass of Sun to that of Earth + Moon	328 900.5596	328 900.55
Ratio of mass of Sun to mass of each planet :		
Jupiter	1047.348 644	1047.350
Saturn	3497.9018	3498.0
Uranus	229 02.98	229 60
Pluto	1.365 66 x 10^8	1.3 x 10^8
Pallas	9.709 x 10^9	9.247 x 10^9
Vesta	7.407 x 10^9	7.253 x 10^9

EXPLANATION

The Sun

Mean elements of the orbit of the Sun can be calculated with the help of the following expressions for use during 2020 only :

Geometric mean longitude	:	L	=	$279^\circ.141\,941 + 0.985\,647\,36\ d$
Mean longitude of perigee	:	Γ	=	$283^\circ.281\,180 + 0.000\,047\,08\ d$
Mean anomaly	:	g	=	$355^\circ.860\,761 + 0.985\,600\,28\ d$
Eccentricity	:	e	=	$0^\circ.016\,701\,22 - 0.\,000\,000\,0012\ d$
Obliquity of the ecliptic w.r.t. mean equator of date	:	ε	=	$23^\circ.436\,678 - 0.000\,000\,36\ d$

where d is the interval in days from 2018 January 0 at 0^h TT and is given by

d = JD $-$ 245 7387.5 = day of the year (pages 4 to 12) + fraction of day from 0^h TT.

The above angular elements are referred to the mean equinox and ecliptic of date. The position of ecliptic of date with respect to the ecliptic of the standard epoch J 2000.0 is given by the formulae given under *Precession.*

The length of the principal years at 2020.0 as derived from the Sun's mean motion are given on page 2.

Geometric longitude of the Sun with respect to the mean equinox of date is tabulated on even numbered pages 18 to 32. Apparent longitude and latitude are with respect to the true equinox and ecliptic of date respectively. The two longitudes are related as follows :

Apparent longitude = Geometric longitude + nutation in longitude $-$ 20''.4955/ R.

Aberration has been computed by dividing 20''.4955 by the true distance to the Sun. Precession in longitude is the total precessional displacement of a point along the ecliptic since the epoch J 2020.5. Revised value of the annual general precession p = 0°. 013 970 98 (for J 2020.5) has been used to compute this quantity. Components of nutation are the results of summation of the revised series of nutation. The sum of the terms with period shorter than 35 days is separately tabulated under Besselian Day numbers (pages 244 to 251).

Apparent Right Ascension and true distance (radius vector), declination (tabulated on odd numbered pages 19 to 33) of the Sun have been computed from the original barycentric rectangular co-ordinates. Although the apparent right ascension and declination have been corrected for light time, the radius vector or the true geocentric distance in astronomical units is the geometric distance at the tabular time.

The Semidiameter is based on a value of $16'\ 01''.18$ at unit distance being inclusive of an allowance for irradiation of $1''.55$. The tabular value is obtained by dividing $16'\ 01''.18$ by the radius vector.

Ephemeris Transit is the TT of the transit of the Sun over the ephemeris meridian which according to its definition, is 1.002 7379 ΔT east of the Greenwich meridian. Here ΔT is the difference TT $-$ UT. This transit time. This transit time can be interpolated to other meridians with an interpolating factor p, as follows:

$$p = -\lambda/360 + 1.002\,7379 \times \Delta T/86400$$

where λ is the longitude (east positive). The interpolated TT can be converted into UT by subtracting ΔT from TT.

Equatorial rectangular co-ordinates (geocentric) of the Sun, referred to the ICRS axes, are given in a.u. on pages 34 to 41. The direction of these axes have been defined by the IAU and realized in practice by the coordinates of several hundred extra galactic radio sources.

EXPLANATION

Horizontal parallax (page 17) of the Sun is the angle subtended at the Sun by the equatorial radius of the Earth. The new value of the Solar parallax $\Pi_{\circ}$ = 8".794 148 has been used to compute the horizontal parallax.

Mean longitude and mean anomaly (page 17) of the Sun have been computed using revised expressions for the mean motion of the Earth around the Sun as given on page 447.

Heliographic co-ordinates given on pages 42 to 45 for 0^h UT include the position angle P of the northern extremity of the axis of rotation measured eastward from the north point of the disc and the heliographic latitude $B_{\circ}$ and longitude $L_{\circ}$ of the central point of the disc.

The observed angular distance ρ_1 from the centre of the disc of the Sun of a feature on the Sun's surface, as seen from the Earth, can be converted into its heliocentric angular distance ρ from the centreof the Sun's disc as follows :

$$\sin(\rho + \rho_1) = \rho_1 / S, \quad \text{where } S \text{ is the semi diameter of the Sun.}$$

The observed position (ρ, θ) of a feature (Sunspot, etc.) with respect to the centre of Sun's disc can be converted into heliographic co-ordinates (L, B) as follows :

$$\sin B = \sin B_{\circ} \cos \rho + \cos B_{\circ} \sin \rho \cos(P - \theta)$$
$$\cos B \sin(L - L_{\circ}) = \sin \rho \sin(P - \theta)$$
$$\cos B \cos(L - L_{\circ}) = \cos \rho \cos B_{\circ} - \sin B_{\circ} \sin \rho \cos(P - \theta)$$

The physical ephemeris of the Sun has been calculated from the elements determined by R. C. Carrington (observation of the spots on the Sun, 1863).

The Synodic rotation numbers are given below according to R. C. Carrington's Greenwich photoheliographic series which commenced on 9 November, 1853 with number 1. The standard solar meridian from which heliographic longitudes on the surface of the Sun are measured (positive towards the west) is that which passes through the ascending node of the solar equator on the ecliptic on 1854 January 1, Greenwich mean noon. The beginning of each synodic rotation is the instant at which the standard solar meridian passes through the central point of the apparent disc of the Sun, i.e., when the heliographic longitude $L_{\circ}$ of this central point is zero.

SYNODIC ROTATION NUMBERS, 2020

Number	Date of Commencement			Number	Date of Commencement			Number	Date of Commencement		
2225	2019	Dec.	10.05	2230		Apr.	24.64	2235		Sept.	7.74
2226	2020	Jan.	6.38	2231		May.	21.87	2236		Oct.	5.01
2227		Feb.	2.72	2232		June.	18.07	2237		Nov.	1.30
2228		Mar.	1.06	2233	2020	July.	15.27	2238		Nov.	28.61
2229		Mar.	28.37	2234		Aug.	11.49	2239	2020	Dec.	25.93
								2240	2021	Jan.	22.27

At the date of commencement of each synodic rotation period, the value of $L_{\circ}$ is zero ; that is, the prime meridian passes through the central point of the disk.

The mean rotational elements of the Sun during 2020 are as follows :

Longitude of the ascending node of the solar equator on the ecliptic of date is 76°.01, and on the mean equator of date 16°.16. Inclination of the solar equator on the ecliptic of date is 7°.25, and on the mean equator of date 26°.10. The mean position of the pole on the solar equator is at right ascension 286°.16 and declination 63°.90. Sidereal period of rotation of the prime meridian is 14°.18 44 per day and its mean synodic period of rotation is 27.2753 days.

EXPLANATION

The Moon

The ephemerides of the Moon reported in this publication are based on the fundamental arguments developed by Simon et. al (1994). The angular elements are referred to the mean equinox and ecliptic of date. Mean elements of the mean equator and of the orbit of the Moon (page 47) can be computed during 2020 with the help of the following expressions :-

The inclination i of the mean equator of the Moon to the true equator of the Earth is given by :

$$i = 23^\circ.705\,7 - 0.001\,409\, d - 0.000\,000\,027\, d^2$$

The arc of the mean equator of the Moon from its ascending node on the true equator of the Earth to its ascending node on the ecliptic of date :

$$\Delta = 281^\circ.774\,6 - 0.052\,264\, d - 0.000\,001\,502\, d^2$$

The arc of the true equator of the Earth from the true equinox of date to the ascending node of the mean equator of the Moon :

$$\Omega' = -\,3^\circ.799\,1 - 0.000\,734\, d + 0.000\,001\,643\, d^2$$

The inclination (I) of the mean equator of the Moon to the ecliptic = $1^\circ\, 32'\, 33''.6$.

The ascending node of the mean lunar equator on the ecliptic is at the descending node of the mean lunar orbit on the ecliptic that is at longitude $\Omega + 180^\circ$.

The above expressions give the mean elements with respect to the true equator of the Earth to a precision of about 0°.001.

The following expressions for the mean elements of the orbit of the Moon Γ', Ω mean longitude of the Moon L' and elongation D are referred to the mean equinox and ecliptic of date.

Mean longitude of the Moon, measured along the ecliptic to the mean ascending node and then along the mean orbit :

$$L' = 332^\circ.128\,231 + 13.176\,396\,46\, d$$

Mean longitude of the Moon's perigee measured in the same way as L' :

$$\Gamma' = 176^\circ.988\,452 + 0.111\,403\,41\, d$$

Mean longitude of the mean ascending node of the lunar orbit on the ecliptic :

$$\Omega = 98^\circ.296\,816 - 0.052\,953\,74\, d$$

Mean elongation of the Moon from the Sun :

$$D = L' - L = 52^\circ.986\,290 + 12.190\,749\,10\, d$$

Mean inclination of the lunar orbit to the ecliptic $= 5^\circ.156\,689\,8$

The above expressions are valid for use in 2020 only.

In all the above expressions, the time argument d is the interval in days since 0^h TT January 0, 2020 and is given by $d = \mathrm{JD} - 245\,8118.5$

The length of the principal mean months at 2020.0 as derived from the above mean orbital elements of the Moon are given on page 2.

The apparent geocentric longitude and latitude of the Moon (pages 48 to 63) are referred to the true equinox and ecliptic of date. The true distance between the centres of the Earth and the Moon is given in a.u. Semi-diameter is derived from the horizontal parallax by $S = \mathrm{Sin}^{-1}(k \sin\pi)$ where $k = 0.272\,5076$. The semi-diameter at mean distance is taken to be $15'\, 32''.58$ without making any correction for irradiation.

EXPLANATION

The right ascension and declination given on pages 64 to 79 for 0 hour & 12 hour of TT are referred to the true equator and equinox of date.

Horizontal parallax is tabulated at twelve hourly intervals on pages 64 to 79. It is derived from $\sin^{-1}(1/r)$ where r is the true distance in units of the Earth's equatorial radius. The tabulated R.A. and declination have been corrected for light time while the horizontal parallax is the geometric value for the tabular time.

The times of New Moon, First Quarter, Full Moon and Last Quarter are the moments at which the excess of the Moon's apparent longitude over that of the Sun is 0°, 90°, 180° and 270° respectively. Moon at Apogee and Perigee are the times when the Moon is at the greatest and least distance from the Earth. The timings are given in U.T. The corresponding timings in U.T. of the phases of the Moon are also given in the calendar portion on pages 4 to 12. For more precise values of the moments of New Moon and Full Moon, a reference may be made to Part VI - Indian Calendar where the times are given in I.S.T.

Moon's Age, given for 0^h TT, is the number of days elapsed since the preceding New Moon (conjunction). The times of Moon's upper and lower transit are given in TT for the ephemeris meridian. Interpolation to any other meridian by means of differences given and with the help of the ephemeris longitude will yield the local mean time of transit. The apparent geocentric declination given for the time of ephemeris transit can also be similarly interpolated.

Physical ephemeris of the Moon (pages 88 to 95) has been computed using the formulae and constants of D. Eckhardt (*The Moon and the Planets, 25 3, 1981; High precision Earth Rotation and Earth-Moon Dynamics, ed. O. Calame, pages 193-198, 1982)* with inclination I as given above (IAU value).

In case of the Moon, selenographic longitudes are measured for a point on the surface of the Moon from the lunar meridian that passes through the mean central point of the visible disc positive towards the west towards Mare Crisium. Selenographic latitudes are reckoned positive towards the north limb. The mean central point of the disc is defined as the point on the lunar surface intersected by the radius of the Moon directed towards the Earth, when the Moon is simultaneously at the ascending node and coincident with the mean longitude.

The Moon presents roughly the same hemisphere to the Earth. However, due to non uniformity of the revolution of the Moon around the Earth (optical libration) and an oscillation of the actual rotational motion of the Moon about its mean rotation (physical libration), about 59% of the Moon's surface can be seen from the Earth. The contribution to the Earth's selenographic longitude and latitude due to physical libration has been tabulated separately. These are geocentric values.

The tabular selenographic longitude and latitude of the Earth are the selenographic co-ordinates of the apparent central point of the Moon from which point the Earth is in selenographic zenith. These co-ordinates are the total librations (sums of optical and physical librations) in longitude and latitude respectively. When the libration in longitude, i.e. the selenographic longitude of the Earth, is positive, the mean central point of the disc is displaced eastward exposing to view a region on the west limb. When the libration in latitude, i.e. the selenographic latitude of the Earth, is positive, a region on the north limb is exposed to view.

The selenographic co-ordinates of the point on the lunar surface where the Sun is in the Zenith are the selenographic co-ordinates of the Sun. The selenographic co-longitude of the Sun tabulated in the ephemeris is obtained by subtracting the selenographic longitude of the Sun from 90° or 450°; it is approximately 270°, 0°, 90° and 180° at new-moon, first quarter, full-moon and last quarter respectively.

The position angle of the axis is the angle that the lunar meridian through the apparent central point of the disc towards the north lunar pole forms with the declination circle through the central point, reckoned counter clockwise from the north point of the disc.

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The position angle of the bright limb is the position angle of the mid point of the illuminated limb, reckoned eastward from the north point of the disc. The position angle of the two cusps may be obtained by adding $\pm 90°$ to that of the bright limb.

The expression for calculating the selenographic altitude (a) of the Sun (above the lunar horizon) at a point at selenographic longitude l and latitude b is as follows :

$\sin a = \sin b_\circ \sin b + \cos b_\circ \cos b \sin (c_\circ + l)$, where $(c_\circ, b_\circ)$ are the Sun's co-longitude and latitude at the time.

The following expressions can be used to compute the differential corrections to be applied to the tabular geocentric librations to form the topocentric librations :

$$\Delta l = -\pi' \sin (Q - C) \sec b$$
$$\Delta b = +\pi' \cos (Q - C)$$
$$\Delta C = +\sin (b + \Delta b)\, \Delta l - \pi' \sin Q \tan \delta,$$

where Q is the geocentric parallactic angle of the Moon and π' is the topocentric horizontal parallax. The latter is obtained from the geocentric horizontal parallax (π) (pages 64 to 79) by using :

$$\pi' = \pi (\sin z + 0.0084 \sin 2 z)$$

where z is the geocentric zenith distance of the Moon. The values of z and Q may be calculated from the geocentric R.A. (α) and declination (δ) of the Moon by using :

$$\sin z \sin Q = \cos \phi \sin h$$
$$\sin z \cos Q = \cos \delta \sin \phi - \sin \delta \cos \phi \cos h$$
$$\cos z = \sin \delta \sin \phi + \cos \delta \cos \phi \cos h$$

where ϕ is the geocentric latitude of the observer and h is the local hour angle of the Moon given by :

$h =$ local apparent sidereal time $- \alpha$

Second differences in the tabular values of the geocentric librations must be taken into account in interpolation for the time of observation.

Major Planets

The heliocentric and geocentric positions of the major planets given on pages 96 to 197 have been derived directly from the numerical integration mentioned on page 446.

The heliocentric longitude and latitude are referred to the mean equinox and ecliptic of date. The tabular argument of heliocentric ephemeris is barycentric dynamical time (TDB).

The apparent geocentric longitude and latitude are referred to the true equinox and ecliptic of date and are planetary aberration. The apparent right ascension and declination are also corrected for planetary aberration and referred to the true equinox and equator of date. The tabular argument for both the terrestrial dynamical time (TDT). The TDT of transit over the ephemeris meridian has been furnished, which may be interpolated to any other meridian to obtain the LMT of transit.

As regards Pluto, in addition to the usual data, figures have been furnished for reduction of the apparent right ascension and apparent declination to the corresponding astrometric places referred to the mean equinox and equator of J 2000.0. The astrometric ephemeris is obtained by first adding the usual planetary aberration to the

EXPLANATION

planet's true geocentric places referred to the standard equinox J 2000.0 and then subtracting the stellar aberration pertinent to the position occupied by the planet. The astrometric place is thus affected by the amount of the terms in the aberration dependent on the longitude of the Earth's perihelion as are the catalogue mean places of stars in the neighbourhood. The astrometric ephemeris is, therefore, rigorously comparable with photographic observations that are referred to catalogue mean places J 2000.0 of neighbouring stars, it being only necessary to correct the observations for geocentric parallax in case of the planets and proper motion in case of the stars.

The tabular true distance from the Earth is the actual geocentric distance at the tabulated time and not at the instant when the light left the planet.

The horizontal parallax of planets is $8''.794\ 143$ divided by the geocentric distance. As regards the semi-diameter, the tabulated value is the value at unit distance divided by the geocentric distance. The semi-diameters at unit distance are as follows : Mercury $3''.36$, Venus $8''.34$, Mars $4''.68$, Jupiter $98''.57$ (Equatorial) and $92''.12$ (Polar), Saturn $83''.13$ (Equatorial) and $74''.96$ (Polar), Uranus $35''.24$, Neptune $34''.14$ and Pluto $2''.07$.

The heliocentric osculating elements of the orbits of the major planets, including Pluto, are given at intervals of 40 days on pages 200 to 201. The osculating elements are the elements of the instantaneous ecliptic orbit of the planet around the Sun determined by its actual position and velocity components for the instant, and as such the elements are affected by the attractions of other planets. The true place of a planet deduced from these elements is thus inclusive of the planetary perturbations, which need not, therefore, be considered separately in such a deduction.

The osculating elements for the Earth refer to the Earth/Moon barycentre. The correction in ecliptic rectangular co-ordinates in conversion from the Earth/Moon barycentre to the Earth's centre is given by :

$$\text{Earth's Centre} = (\text{Earth / Moon barycentre}) - (0.000\,0312 \cos L,\ 0.000\,2865 \sin L,\ 0.0000124 \sin L,$$
$$-0.00000718 \sin L, 0.00000657 \cos L, 0.00000285 \cos L)$$

where $L = 218^\circ + 481\,268^\circ\, T$, with T measured in Julian centuries from JD 245 1545.0 to 5 decimals; the co-ordinates are in a.u. with reference to mean equinox and ecliptic of date.

PART II - STARS

The mean places of 482 stars, apparent places of 68 stars at 10-day intervals. daily apparent place of *Polaris* and tables for finding latitude of place from altitude of polaris and azimuth of polaris are given in this section. The ecliptic co-ordinates (mean longitude and latitude) of 451 stars have also been given. To facilitate reduction from mean to apparent place of a star, Besselian Day Numbers as well as the barycentric position and velocity components of the Earth alongwith rotation matrix elements for precession and nutation have been tabulated.

Mean Places of Stars (pages 215 to 226)

Beginning with the issue for 1988, calculation of the mean and apparent places are based directly on the basic-FK5 compiled by the A.R.I., Heidelberg.

The table for mean places of stars includes all stars of magnitude upto 3.9 as well as the component stars of the different lunar asterisms of the Hindus, Chinese and Arabian even when those are fainter than magnitude 3.9.

In case double or multiple stars, *m* denotes the mean position of the centre of gravity (*c.g.*) of the system; *p* the preceding component having less right ascension, *f* the following component and *A* the brighter component of the system. The magnitude of the binary stars is the integrated value for the two components.

EXPLANATION

The mean longitude and latitude of 451 important stars have been computed using the conversion from equatorial mean positions to ecliptic co-ordinates. Similarly, annual variations in longitude and latitude, etc., are the differentials of the conversion formulae. All quantities relate to the middle of the current Julian year.

Apparent Places of Stars (pages 227 to 243)

The apparent places of 68 selected stars are reported under this section. These positions are completely based on the FK5 beginning with the issue for 1988.

Smaller aberration has been computed from the total velocity of the Earth referred to the barycentre of the solar system. The E-terms of aberration are no longer included in the mean places in the FK5, but rather in the reduction from mean to apparent places.

Reductions to apparent places have been computed rigorously and directly without the intermediary of the mean place for the begining of the year. The rigorous computation also includes effects of relativistic light deflection. Because of this, the apparent places of a star when approaching very closely the Sun cannot be interpolated by the user, but these cases are of no practical interest in normal applications.

Apparent places of 68 bright stars with annual variation and annual proper motion at 10-day interval have been given on pages 227 to 243. The number, name, are taken generally from the FK5, magnitude and spectrum are taken from SIMBAD data base. Corrections for parallax have been applied where appreciable.

The right ascension and declination are referred to the true equator and equinox of date but with the omission of the short period terms of nutation. After interpolating the given apparent places to date and longitude of the station, the following corrections for the effect of short period terms of nutation are to be applied :

$$\Delta\alpha = a\,d\psi + b\,d\varepsilon \quad \text{seconds of time}$$
$$\Delta\delta = a'\,d\psi + b'\,d\varepsilon \quad \text{seconds of arc}$$

where $d\psi$ and $d\varepsilon$ are short period terms of nutation as tabulated on pages 244 to 251. The values of a, b, a' and b' are given for each star under the apparent place.

The Apparent places of Polaris for each day of the year (pages 272 to 274) have been computed rigorously.

Besselian Day Numbers (pages 244 to 251)

All stellar data tabulations are now for the standard epoch at the middle of the current Julian year rather than the beginning of the Besselian year and accordingly the Besselian Day Numbers and second order day numbers are referred to the mean equator and equinox of the epoch, J 2020.5. Although for full precision the reduction to the apparent place has to be computed rigorously as described below, Besselian Day Numbers can still be used for less precision.

In the tabulated data, τ is the fraction of the Julian year since the standard epoch J 2020.5 A, B and E are Besselian Day Numbers designed to incorporate corrections to the position of a star on account of precession and nutation. In this case, the correction due to precession is measured from the middle of the year, and this is secured by incorporating in A the value of the precision corresponding to τ.The terms of short-period in nutation are included in A and B, which are also shown separately on pages 244 to 251.

The Besselian Day Numbers C and D, designed to include the effect of aberration, are now computed based on the total velocity of the Earth.

Second order day numbers, needed only for high declination stars for high accuracy, have been tabulated on pages 252 to 255.

EXPLANATION

The barycentric position and velocity components of the Earth and rotation matrix elements for rigorous reduction of precesision and nutation have been tabulated on pages 256 to 270. Use of these data with examples is discussed below :-

Apparent place reduction with full precision (rigorous method)

Conversion of the barycentric co-ordinates of a star for the standard equinox and equator of J 2000.0 (TDB) to its apparent geocentric co-ordinates referred to the true equinox and equator of date (TT) can be done rigorously as follows:

The geocentric vector **P** of the star at the required epoch (ignoring the distinction between TDB and TT for the stellar case) is given be by:

$$\mathbf{P} = \mathbf{q} + T\mathbf{m} - \pi\mathbf{E_B} \quad \ldots\ldots\ldots(1)$$

Here **q** is the barycentric direction of the star at epoch J 2000.0 referred to the standard equinox and equator of J2000.0 and is given by :-

$$\mathbf{q} = (\cos\alpha_0 \cos\delta_0 ,\ \sin\alpha_0 \cos\delta_0 ,\ \sin\delta_0)$$

where α_0 and δ_0 are the right ascension and declination for the equator, equinox and epoch of J 2000.0.

The space motion vector $\mathbf{m} = (m_x, m_y, m_z)$ of the star in equation (1), expressed in radians/century, is given by :

$$\begin{aligned}
m_x &= -\mu_\alpha \cos\delta_0 \sin\alpha_0 - \mu_\delta \sin\delta_0 \cos\alpha_0 + \nu\pi\cos\delta_0 \cos\alpha_0 \\
m_y &= \mu_\alpha \cos\delta_0 \cos\alpha_0 - \mu_\delta \sin\delta_0 \sin\alpha_0 + \nu\pi\cos\delta_0 \sin\alpha_0 \\
m_z &= \mu_\delta \cos\delta_0 + \nu\pi\sin\delta_0
\end{aligned}$$

where these expressions take into account the radial velocity (v) in au/century (1 km/s = 21.094 952 75 a.u./ century), measured positively away from the Earth as well as proper motion(μ_α, μ_δ) in right ascension and declination in radian/century and π is the parallax in radians.

T is the interval in Julian centuries from J2000.0, given by $T = (JD - 245\,1545.0)/\,36525$; $\mathbf{E}_B$ and $\dot{\mathbf{E}}_\mathbf{B}$ in a.u. per day are Earth's barycentric position and velocity vectors at co-ordinate time t = TDB referred to the equator and equinox of J 2000.0 (pages 256 to 270).

The heliocentric position of the Earth **E** is given by

$$\mathbf{E} = \mathbf{E}_B - \mathbf{S}_B \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where $\mathbf{S_B}$ is the barycentric position of the Sun at time t. This can be obtained from the heliocentric position of the barycentre tabulated on page 202 by reversing the sign of the respective x, y, and z.

The geocentric direction **p** of the star and the unit vector **e** can be computed from $\mathbf{p} = \mathbf{P}/|\mathbf{P}|$ and $\mathbf{e} = \mathbf{E}/|\mathbf{E}|$

The geocentric direction $\mathbf{p_1}$ of the star after applying the correction for light deflection in the natural frame is obtained as follows:

$$\mathbf{p_1} = \mathbf{p} + (2\ \mu/c^2 E)\,(\mathbf{e} - (\mathbf{p.\,e})\,\mathbf{p})/\,(1 + \mathbf{p.\,e}) \ldots\ldots\ldots\ldots(3)$$

EXPLANATION

Where $\mu/c^2 = 9.87 \times 10^{-9}$ a.u and $E = |\mathbf{E}|$, the vector $\mathbf{p_1}$ is a unit vector to the order of μ/c^2 and dot (**.**) indicates scalar product.

The proper direction $\mathbf{p_2}$ in the geocentric inertial frame, that is moving with the instantaneous velocity **V** of the Earth relative to the natural frame, is given by:

$$\mathbf{p_2} = (\beta^{-1}\mathbf{p_1} + (1 + \mathbf{p_1}.\mathbf{V})/(1+\beta^{-1}))\mathbf{V}) / (1+\mathbf{p_1}.\mathbf{V}) \ldots\ldots\ldots\ldots\ldots(4)$$

Where $\mathbf{V} = \dot{\mathbf{E}}_\mathbf{B}/c = 0.0057755\,\dot{\mathbf{E}}_\mathbf{B}$ and $\beta = (1 - V^2)^{-1/2}$; the velocity **V** expressed in units of velocity of light and is equal to the Earth's velocity in the barycentric frame to the order of V^2.

The apparent geocentric direction $\mathbf{p_3}$ is obtained by applying precession and nutation to the proper direction $\mathbf{p_2}$ by multiplying it row by column with the rotation matrix M=NPB (given on pages 257 to 271) as follows:

$$\mathbf{p_3} = M\,\mathbf{p_2} \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots..\ (5)$$

The above direction $\mathbf{p_3}$ is in rectangular co- ordinates (ξ, η, ζ). It can be converted into spherical co- ordinates (α, δ) using :

$$\alpha = \tan^{-1}(\eta/\xi) \quad \text{and} \quad \delta = \tan^{-1}(\zeta/\beta) \ldots\ldots\ldots\ldots\ldots\ldots(6)$$

Where $\beta = (\xi^2 + \eta^2)^{1/2}$

where the quadrant of α can be determined by the signs of ξ and η.

Correction for polar motion :

The apparent geocentric direction $\mathbf{p_3}$, given by equation (5) above, is for the true equator and equinox with the z axis pointing towards the celestial ephemeris pole. A further correction for polar motion may be applied to $\mathbf{p_3}$ to obtain $\mathbf{p_4}$ i.e. the direction relative to the conventional terrestrial reference system in which the z-axis is in the direction of the adopted mean position of the pole, as follows :

$$\mathbf{p_4} = \mathbf{R_2}(-x)\,\mathbf{R_1}(-y)\,\mathbf{R_3}(\text{GAST})\,\mathbf{p_3}$$

where GAST is the Greenwich apparent sidereal time at the corresponding instant of UT and

$$\mathbf{R_1}(\theta) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & \sin\theta \\ 0 & -\sin\theta & \cos\theta \end{bmatrix} \qquad \mathbf{R_2}(\theta) = \begin{bmatrix} \cos\theta & 0 & -\sin\theta \\ 0 & 1 & 0 \\ \sin\theta & 0 & \cos\theta \end{bmatrix}$$

$$\mathbf{R_3}(\theta) = \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

are the standard matrices that produce rotations through an angle θ about the x, y and z - axes respectively.

Polar motion is described by x and y, the co- ordinates of the celestial ephemeris pole with respect to the adopted origin; x and y are measured in seconds of arc from the origin along the meridians at longitudes 0° and 270°. Current values for the reduction of observations are published by the International Polar Motion Service and the Bureau International de l' Heure.

EXPLANATION

Example of stellar reduction :

Calculation of apparent position of a fictitious star on 2020, January 1 at 0^h TT from the catalogue data, mean right ascension (α_0) , declination (δ_0), centennial proper motion (μ_α , μ_δ) in right ascension and declination, parallax (π) and radial velocity (ν) of a fictitious star for the standard equinox and equator of J 2000.0 (TDB) as given below:

$\alpha_0 = 14^h\ 39^m\ 36^s.087$ | $\mu_\alpha = -49.486$ s/ century $= -0.003\,598\,7$ rad/century

$\delta_0 = -60°\ 50'\ 07''.14$ | $\mu_\delta = +69''.60$ s/ century $= +0.000\,337\,4$ rad/ century

$\pi = 0''.752 = 3.646 \times 10^{-6}$ rad | $\nu = -22.2$ km/ s, $\nu\pi = -0.001\,707\,4$ rad/ century

The barycentric position vector of the Sun and the position and velocity vectors of the Earth referred to J2000.0 on 2020 January 1, 0^h TDB (pages 202, 256 to 270) are :

Vector	Julian date	Barycentric Rectangular Components		
		x	y	z
$\mathbf{E}_B$	245 8849.5	−0.170 144 389	+ 0.895 983 831	+ 0.388 436 660
$\dot{\mathbf{E}}_\mathbf{B}$	245 8849.5	−0.017 247 546	−0.002 737 580	−0.001 186 171
$\mathbf{S}_\mathbf{B}$	245 8849.5	+ 0.003 798 625	+0.006 816 842	+0.002 980 565

In order to calculate the geocentric vector **P** of the star at J 2000.0, using equation (1), the vectors **q** and **m** may be computed using positional data of the star.

$\mathbf{q} = (-0.373\,854\,098,\quad -0.312\,594\,565,\quad -0.873\,222\,624)$

$\mathbf{m} = (+0.000\,712\,684,\quad +0.001\,690\,102,\quad +0.001\,655\,340)$

$\mathbf{T} = (245\,8849.5 - 245\,1545.0)/\,36525 \quad = \quad +0.199\,986\,311$

The geocentric vector **P** may be computed from equation (1) by substituting the vectors **q, m** and $\mathbf{E}_\mathbf{B}$ and time **T**.

$\mathbf{P} = (-0.373\,996\,005,\quad -0.312\,256\,567,\quad -0.872\,891\,579)$ and $|\mathbf{P}| = 0.999\,658\,384$

The heliocentric position vector **E** of earth may be obtained using equation (2)

$\mathbf{E} = (-0.166\,345\,764,\quad +0.889\,166\,989,\quad +0.385\,456\,095)$ and $|\mathbf{E}| = 0.983\,293\,063$

The unit vectors **p** and **e** in the direction of **P** and **E** respectively are as follows :

$\mathbf{p} = (-0.374\,123\,812,\quad -0.312\,363\,276,\quad -0.873\,189\,875)$

$\mathbf{e} = (-0.169\,172\,112,\quad +0.904\,274\,648,\quad +0.392\,005\,303)$

The scalar product $\mathbf{p.\,e} = -0.561\,465\,937$ and $2\mu/c^2 = 1.974 \times 10^{-8}$ a. u. The second term in the equation (3) represents the correction for the light deflection in the natural frame, and is given by the following vector :

$(2\mu/c^2\mathbf{E})\,(\mathbf{e} - (\mathbf{p.\,e})\,\mathbf{p})/\,(1+\mathbf{p.\,e}) = (-0.000\,000\,017,\quad +0.000\,000\,032,\quad -0.000\,000\,004)$

EXPLANATION

Addition of the above correction to the unit vector **p** gives geocentric direction $\mathbf{p_1}$ of the star :

$\mathbf{p_1}$ = (– 0.374 123 829, – 0.312 363 243, – 0.873 189 879)

The velocity vector **V** = 0.005 7755 $\dot{\mathbf{E}}_{\mathbf{B}}$ and $\beta^{-1} = (1 - V^2)^{1/2}$ are as follows:

V = (– 0.000 099 613, – 0.000 015 811, – 0.000 068 507)

β^{-1} = 0.999 999 995

The scalar product $\mathbf{p_1} . \mathbf{V}$ = + 0.000 048 188

Now substituting quantities computed above in the equation (4), the proper direction is obtained as:

$\mathbf{p_2}$ = (– 0.374 205 410, – 0.312 364 000, – 0.873 154 650)

The precession and nutation matrix (**M**) from page 257 is as follows:

$$\mathbf{M} = \begin{bmatrix} +0.999\,988\,499 & -0.004\,398\,726 & -0.001\,911\,210 \\ +0.004\,398\,742 & +0.999\,990\,325 & +0.000\,004\,106 \\ +0.001\,911\,174 & -0.000\,012\,513 & +0.999\,998\,174 \end{bmatrix}$$

Finally the apparent geocentric direction $\mathbf{p_3}$ is obtained by multiplying the proper direction $\mathbf{p_2}$ to the precession and nutation matrix as given by the equation (5).

Thus $\mathbf{p_3}$ = (– 0.371 158 321, – 0.314 010 597, – 0.873 864 318) and the apparent right ascension and declination:

$\alpha = \tan^{-1}(\eta/\xi) = 14^h\ 40^m\ 55^s.723$; $\delta = \tan^{-1}(\zeta/\beta) = -60^\circ\ 54''\ 39'.066$

EXPLANATION

PART III - Tables of Sunrise, Sunset, Twilight and Moonrise, Moonset

The times of Sunrise, Sunset and Twilight, which can be obtained immediately from the given tables by simple interpolation for the desired latitude within the scope of the tables, are in local mean time of the place. Strictly speaking, the timings of these events are for places on the meridian of Greenwich. By simple interpolation for longitude, the correct time (L.M.T.) for the station can be obtained, which can thereafter be reduced to the zonal standard time by applying correction of time pertinent to the place.

At the given times of Sunrise and Sunset, the upper limb of the Sun is on the horizon; the true zenith distance of the Sun's center is then taken as 90° 50′, allowing 16′ for semi- diameter and 34′ for horizontal refraction.

The timings of the beginning of morning twilight and ending of evening twilight relate to the instants when the center of the Sun is 18° below the horizon. This is now known as astronomical twilight. The period of twilight has been divided into three parts − Civil when the Sun is 6° below the horizon, Nautical when 12° and Astronomical when 18° and their duration have been given.

The timings of rising and setting in U.T. of a body with right ascension α, declination δ and zenith distance z at latitude ϕ and east longitude λ may be computed from

$$UT = 0.99727\,[\alpha - \lambda \pm \cos^{-1}\{(\cos z - \sin\phi \sin\delta)/(\cos\phi \cos\delta)\} - \text{GAST at } 0^h\,UT],$$

where each term is expressed in time measure and GAST at 0^h UT as tabulated on page 13. The negative sign in the expression corresponds to rising and positive sign to setting. If the quantity $\{(\cos z - \sin\phi \sin\delta)/(\cos\phi \cos\delta)$ is numerically greater than one, there is no phenomenon. However, the tabulated timings of Moonrise and Moonset have been computed by inverse by interpolation for the zenith distance at $z = 90° 34'.001 - 0.72755\,\pi$, where π is the horizontal parallax of the Moon at the time of phenomena. The above value includes semi-diameter and the effect of refraction.

The Sunrise and Sunset times for certain stations in India (Kolkata, Varanasi, Chennai, Delhi, Mumbai) have been separately computed and given in Indian Standard Time. In these calculations the amount of horizontal refraction has been taken as 31′, the value derived from consideration of the atmospheric conditions in India, and consequently the zenith distance of the Sun's center is 90° 47′ at the times given. In the section on Indian Calendar, the Sunrise and Sunset times which have been given for latitude 23° 11′ North and Central Meridian of India, also relates to the times when upper limb of the Sun is on the horizon as in the general tables.

The Moonrise and Moonset times given for certain latitudes relate to the local mean time calculated for the Central Meridian of India. By simple interpolation with the help of a table given on page 313, the local mean time for any other latitude can easily be obtained. At the time given, the Moon's upper limb is on the horizon and so the true geocentric zenith distance of the Moon's center is 90° 34′ *plus* semi- diameter of the Moon *minus* the horizontal parallax, where 34′ has been allowed for horizontal refraction. Taking the mean values of the semi-diameter and the parallax, the zenith distance of the Moon at the moment is about 89° 52′, which varies from 89° 55′ to 89° 49′ as the parallax increases from 53′.6 to 61′.9.

The times of Moonrise and Moonset for certain stations in India (Kolkata, Chennai, Delhi and Mumbai) are separately calculated and given in I.S.T.

The times of Sunrise, Sunset and Moonrise, Moonset given are for an observer on the surface of the Earth considered to be a flat surface around that point without any obstruction in the directions of rising or setting. For an observer stationed at some elevation above the surface, the rising will be further accelerated and the setting retarded according to the height of the observer. The additional arc of depression to be considered on this account is $2'.10\sqrt{h}$ where h is the height of the observer in meters above the ground level. The dip of the sensible horizon is however $1'.77\sqrt{h}$. The effect of atmospheric refraction is included in the above results, without which both the terms would have got reduced to the same value of $1'.93\sqrt{h}$.

EXPLANATION

The values of the arc of depression according to height of the observer are given below:

Height	Depression	Height	Depression	Height	Depression	Height	Depression
Meters	′	Meters	′	Meters	′	Meters	′
0	0.0	40	13.3	300	36	2000	94
2	3.0	50	14.8	400	42	3000	115
5	4.7	75	18.2	500	47	4000	133
10	6.6	100	21.0	750	58	5000	148
20	9.4	150	25.7	1000	66	6000	163
30	11.5	200	29.7	1500	81	7000	176
40	13.3	300	36.4	2000	94	8000	188

The correction to the rising and setting times due to the above height of the observer may be obtained by multiplying the arc of depression given in the table by the figures from the table below:

Latitude of Station

Decli. of Sun	0°	10°	20°	30°	35°	40°	45°	50°	52°	54°	56°	58°	60°
° ′	m	m	m	m	m	m	m	m	m	m	m	m	m
0	.067	.068	.071	.077	.082	.087	.094	.104	.108	.113	.119	.126	.133
5	.067	.068	.071	.077	.082	.088	.095	.105	.109	.115	.121	.127	.135
10	.068	.069	.072	.079	.083	.089	.097	.108	.113	.119	.126	.133	.142
15	.069	.070	.074	.081	.086	.093	.101	.113	.119	.127	.134	.144	.156
20	.071	.072	.076	.084	.090	.097	.108	.123	.130	.139	.151	.165	.183
23 27	.073	.074	.078	.087	.093	.102	.114	.132	.142	.155	.171	.192	.223

The deviation of the rising or the setting point on the horizon (i.e., amplitude) on account of the above arc of depression h (obtained after adding to it the normal depression at rising or setting) may be found as $h \tan \phi \sec A$, deviation being towards the north in the northern hemisphere and south in the southern hemisphere. Here A, the amplitude of the rising of setting point measured from the east or west point of the horizon, is obtained from $\sin A - \sin\delta \sec\phi$. The values of the amplitude for certain latitudes and declinations are given in a table on page 369.

PART IV — ECLIPSES AND OCCULTATIONS

Eclipses and Occultations have been calculated on the basis of the tabulated positions of the Sun and the Moon. The semi-diameters of the Sun and the Moon used in these calculations exclude irradiation. The Sun's tabular semi-diameter which includes irradiation is diminished by 1."55 for this purpose.

The semi-diameter of the Moon given by $\sin s = k \sin \pi$, where π is the Moon's horizontal parallax is based on the adopted constant $k = 0.272\,5076$ to account for the irregularities of the lunar limb. It corresponds to the mean radius of Watt's datum as determined by observations of occultations and to the adopted radius of the Earth, introduced in 1982 and is consistent with the IAU system of Astronomical constants (1976). It is used with effect from 1986 in this publication. Refraction is neglected in calculation of eclipses of both the Sun and the Moon.

EXPLANATION

The circumstances of the phenomena are given provisionally in Universal Time, using ΔT (A) = + $69^s.0$ and the points on the Earth's surface are also expressed in terms of geographic longitude measured positively to the east.

Lunar Eclipses

In the calculation of lunar eclipses, the semi-diameter of the shadow -cone has been increased by one-fiftieth to take account of the influence of the atmosphere in absorbing Sun's rays passing through it . In the calculation of rising and setting limits, the time when the centre of the Moon becomes visible on the horizon has been considered as rising or setting. Elsewhere in this book the upper limb visible on the horizon is taken as the criterion for rising or setting. The horizontal refraction used in these calculations of rising and setting is 31′.

The method of computation of a lunar eclipse is detailed below :

Let α, δ be the right ascension and declination of the Moon at an instant T_0 at or very near to the moment of opposition, and let α', δ' be the corresponding co-ordinates of the centre of the Earth's shadow (α'= R. A. of Sun + 12^h, δ' = Sun's declination). Let π, s be parallax and semi-diameter of the Moon and π', s' be parallax and semi-diameter of the Sun.

As the Earth is not a perfect sphere, its shadow will differ slightly from a cone. It would however, be sufficient for our purpose if we use a mean radius for the Earth, which is equivalent to submitting for π a parallax π_1, reduced to latitude 45°, so that $\pi_1 = 0.9983\ 33\ \pi$.

The radius of the shadow-cone at Moon's distance is 1.02 ($\pi_1 + \pi' - s'$) for umbra, and 1.02 ($\pi_1 + \pi' + s'$) for penumbra.

Let L be the angle between the centre of the Moon and that of the shadow-cone at the desired circumstance of the eclipse, so that

$L_1 = 1.02\ (\pi_1 + \pi' - s') + s$ . . . . . . for first and last contacts

$L_2 = 1.02\ (\pi_1 + \pi' - s') - s$ . . . . . . for second and third contacts

For the penumbral eclipse,

$L' = 1.02\ (\pi_1 + \pi' + s') + s$ . . . . . . for first and last contacts

The Besselian elements x, y may be computed with sufficient accuracy with the following :

$x = (\alpha - \alpha')\cos\delta$ $\quad$ x' = hourly variation of $(\alpha - \alpha')\cos\delta$

$y = (\delta - \delta')$ $\quad$ y' = hourly variation of $(\delta - \delta')$

Let $m \sin M = x$, and $m \cos M = y$, so that $\tan M = x/y$, and $m^2 = x^2 + y^2$. The quantity m, taken always positive at all times, represents the angular distance between the centre of the Moon and of the shadow cone. The angle M may take any value from 0° to 360°.

Again, let $n \sin N = x'$, and $n \cos N = y'$, so that $n^2 = x'^2 + y'^2$, and $\tan N = x'/y'$. The angle N lies in the first or the second quadrant according as y' is positive or negative. The value of n is positive.

The time of greatest obscuration or middle of the eclipse is given by

$$T_0 - 1/n\ \{ m \cos(M - N) \} \quad \text{or} \quad T_0 - (x x' + y y')/n^2 \quad \text{(hours)}$$

EXPLANATION

The auxiliary angle ψ is given by :

$\sin \psi = \{ m \sin (M - N) \} / L = (x y' - y x') / nL$. The value of either L_1, L_2 or L' should be used or L according to the circumstances of the eclipse under consideration.

Then, time of the beginning or ending = time of middle + (1/n) ($L \cos \psi$).

The value of ψ should be so taken that $\cos \psi$ may be negative for the beginning and positive for the ending of the phase. In other words, when $\sin \psi$ is positive, i.e., when $(M - N)$ falls in the 1st or the 2nd quadrant, ψ would be in the second quadrant for the beginning and in the first quadrant for the ending; and when $\sin \psi$ is negative, i.e., when $(M - N)$ is in the 3rd or the 4th quadrant, ψ would be in the third quadrant for the beginning and fourth quadrant for the ending.

If greater accuracy is desired, the computations may be repeated using the times obtained above as initial times.

The magnitude of the eclipse, the Moon's diameter being unity, is $(L_1 - \Delta) / 2s$,

where $\Delta = m \sin (M - N)$ is taken positive. When the computations are repeated for greater accuracy, the average values of L_1, Δ and s for the first and last umbral contacts or those corresponding to the time of greatest obscurations should be used.

When Δ becomes less than L_2, the eclipse is a total one. The computations of the beginning and ending of the total phase may be done in the same way as above using the value of L_2.

The position angle of contact P on the Moon's limb, measured from the north point in the direction N.E.S.W. is $180^\circ + N + \psi$ for the first and last contacts both with umbra and penumbra as the case may be, and is $N + \psi$ for the second and third contacts in case of a total eclipse.

When M is calculated for the exact time of the phenomena, i.e., beginning or ending, then P may be obtained by considering $N + \psi = M$, i.e., $P = M + 180^\circ$ or $P = M$ as the case may be.

Solar Eclipses

Computation of the elements and circumstances of solar eclipses has been done following the method of Bessel. The geometric position of the shadow of the Moon relative to the Earth is described by the Besselian elements in a system of geocentric rectangular co-ordinates. In this system, the geocentric plane perpendicular to the axis of the shadow is taken as the xy plane and called the fundamental plane. The x-axis is the intersection of the fundamental plane with the plane of equator and is positive towards east. The y-axis is positive towards the north. The z-axis is parallel to the axis of the shadow and is positive towards the Moon. The tabular values of x and y are the co-ordinates of the axis of the shadow on the fundamental plane in units of the Earth's equatorial radius. The quantities d and μ specify the declination and hour angle of the point on the celestial sphere towards which the axis of the shadow is directed.

The elements l_1 and l_2 are the radii of the penumbral and umbral cones on the fundamental plane. The elements l_2 is regarded as positive for an annular eclipse and negative for a total eclipse. The elements f_1 and f_2 are the angles between the axis of the shadow and the generators of the penumbral and umbral cones respectively.

The Besselian elements x, y, sin d, cos d, μ, l_1 and l_2 are computed and tabulated at an interval of 10 minutes to facilitate the accurate computation of the circumstances of the eclipse. The given eclipse maps show the path of the eclipse, beginning and ending times of the eclipse, the area of visibility and rising and setting limits of the eclipse.

EXPLANATION

The method of computation of the local circumstances of the solar eclipse is given below :

The approximate time (U.T.) of the beginning and ending of a solar eclipse may be obtained from the corresponding eclipse map and used as estimated initial time. To obtain the geocentric rectangular co-ordinates, ξ, η, ζ of the observer located on the surface of the Earth in geographic longitude λ (measured east positive) and latitude ϕ in terms of the Besselian elements, we have;

$$\xi = \rho \cos \phi' \sin H$$

$$\eta = \rho \sin \phi' \cos d - \rho \cos \phi' \sin d \cos H$$

$$\zeta = \rho \sin \phi' \sin d + \rho \cos \phi' \cos d \cos H$$

and their variations per minute as :

$$\xi' = \mu' \rho \cos \phi' \cos H$$

$$\eta' = \mu' \xi \sin d - \zeta d'$$

where $H = \mu + \lambda$ and μ' is variation per minute in hour angle. In most of the cases, the variation ζ' is not needed and may be neglected. The values of $\rho \cos \phi'$ and $\rho \sin \phi'$ used above may be found for the observer's latitude ϕ using Table – XI.

The eclipse begins or ends at the station when $(x - \xi)^2 + (y - \eta)^2 = (l_1 - \zeta \tan f_1)^2$.

Now let $m \sin M = x - \xi$, $m \cos M = y - \eta$ so that $\tan M = (x - \xi)/ (y - \eta)$ and $m^2 = (x - \xi)^2 + (y - \eta)^2$. The angle M may have any value from 0° to 360° and m is always positive.

Again let $n \sin N = x' - \xi'$, $n \cos N = y' - \eta'$ so that $\tan N = (x' - \xi')/ (y' - \eta')$ and $n^2 = (x' - \xi')^2 + (y' - \eta')^2$. The angle N is in the first two quadrants and n is positive.

The radius of the shadow at a height ζ above the fundamental plane may be determined by $L_1 = l_1 - \zeta \tan f_1$ or $L_2 = l_2 - \zeta \tan f_2$ as the case may be.

Now the required time of the event will be obtained by applying a correction τ to the adopted initial time concerned, given by

$$\tau = - \{m \cos (M - N)\}/n + (L \cos \psi)/n \quad \text{(in minutes)}, \quad \text{where } \sin \psi = \{m \sin (M - N)\}/L$$

The value of ψ for which $\cos \psi$ is negative should be taken for the beginning of the eclipse for the beginning of the annular phase or the end of the total phase, and the value of ψ for which $\cos \psi$ is positive is to be taken for the end of the eclipse, for the end of the annular phase or the beginning of the total phase. When $M - N$ falls within 0º to 180º, ψ is in the 2nd or the 1st quadrant according to the required phase of the eclipse, for the other half it is in the 3rd or the 4th quadrant according to the phase.

If the correction τ obtained above exceeds 3 or 4 minutes and greater accuracy is desired, the computation should be repeated using the new times now obtained as initial times.

For finding the time of greatest phase , the calculations should be started adopting a new assumed time midway between the beginning and ending times. The correction to this adopted time is given by:

$$\tau = - \{m \cos (M - N)\}/n \text{ (in minutes).}$$

EXPLANATION

The magnitude of greatest partial eclipse is the fraction of the Sun's diameter obscured by the Moon at the time of greatest phase, and is given by : $M_1 = (L_1 - \Delta) / (2 L_1 - 0.5459)$ where Δ, the minimum distance between the centres of the two bodies, is given by $m \sin (M - N)$ and is to be taken positive.

The magnitude of the central phase, in the same units, is $M_2 = (0.5459) / (2 L_1 - 0.5459)$.

The position angle of the point of contact measured from the north point of the Sun in the direction N. E. S. W. (i.e. clockwise direction) may be obtained from $P = N + \psi$ or if, measured from the vertex, from $V = P - C$ where C, the parallactic angle, is given by $\tan C = (\xi / \eta)$.

Occultations

The occultations of visible planets and certain bright stars (*Aldebaran , Regulas, Spica and Antares)* by the Moon are given whenever they occur, together with the time, area of visibility and the Besselian elements. The area of visibility includes also the regions from which the occultations is visible even during day light hours. The two times given in the first table for the occultations are the times of first and last contact of the shadow cylinder with the Earth and as such the occultation may be expected to be visible only within the period between these times.

The elements are similar to those for solar eclipses and are given for T_0, the instant of conjunction in R.A. when x = 0. The common geocentric hour angle of the bodies, or more precisely of the line passing through the center of the Earth parallel to the line joining the center of the two bodies for the Greenwich meridians is H_0 and its hourly variation is about $60^{m}.16$ or $15^{o}.04$. Y is the value of y for the instant of conjunction and x', y' are the hourly variations of x and y. For a place where an occultation is visible, the times of immersion and emersion can be computed with the help of these elements by a method similar to that used in computing the local circumstances of a solar eclipse as explained below:

Let φ and λ be respectively the latitude and longitude of the place. The longitude of place is to be taken in hours and minutes and as usual measured positively towards east of Greenwich.

For night visibility of an occultation, the necessary conditions are as follows:

(1) The Sun must not be much more than an hour above the horizon at the local mean time $T_0 + \lambda$ (and it must be below the horizon at time $T_0 + \lambda + t$).

(2) The Moon must be above the horizon by an appreciable amount, i.e., the quantity $H_0 + \lambda$, taken without regard to sign for this purpose, must be less than the semidiurnal are of the star of planet by at least one hour.

For prediction of an occultation, find the approximate time (U.T.) of local apparent connection by applying to the given T_0 a correction t (in hours) taken from the following table*:

$H_0 + \lambda$

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
φ	0-00	0-30	1-00	1-30	2-00	2-30	3-00	3-30	4-00	4-30	5-00	5-30	6-00
	h	h	h	h	h	h	h	h	h	h	h	h	h
0°	0.00	0.41	0.77	1.08	1.32	1.50	1.62	1.69	1.72	1.73	1.71	1.65	1.58
10°	0.00	0.40	0.75	1.06	1.29	1.47	1.59	1.66	1.70	1.70	1.69	1.63	1.56
20°	0.00	0.37	0.70	0.99	1.21	1.38	1.51	1.58	1.62	1.63	1.61	1.56	1.50
30°	0.00	0.32	0.62	0.87	1.08	1.24	1.36	1.44	1.49	1.50	1.50	1.45	1.40
40°	0.00	0.26	0.51	0.73	0.92	1.07	1.18	1.26	1.30	1.32	1.32	1.30	1.26
50°	0.00	0.20	0.40	0.58	0.73	0.86	0.96	1.03	1.08	1.11	1.11	1.10	1.07
60°	0.00	0.15	0.29	0.42	0.53	0.63	0.72	0.78	0.83	0.85	0.87	0.86	0.85

*The value of t has the same sign as that of $\sin (H_0 + \lambda)$.

The Besselian elements x and y at the time of local conjunctions $T_0 + t$ may be calculated as follows :

$x = x' t$, and $y = Y + y' t$.

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Occultations for which $y - \eta$ for the time local conjunction is not within ± 0.35 will not be visible at the place. In order to decide this, an estimated value of η may be used as an approximation for which the following tables are given indicating the minimum and maximum values of η.

Limiting value of η (when on meridian i.e., when $H_0 + \lambda = 0$)

φ - d ………	0°	10°	20°	30°	40°	50°	60°
η ………	0.00	0.17	0.34	0.50	0.64	0.76	0.86

The values of η has the same sign as that of φ - d.

(* The table has been constructed taking $x' = 0.5773$; for other values of x' the figures will vary inversely. For this purpose the figures of the table may be multiplied by 1.15 for $x' = 0.50$, by 1.05 for $x' = 0.55$, by 0.95 or $x' = 0.60$ and by 0.89 for $x' = 0.65$)

Limiting value of η (when rising or setting i.e. when $H_0 + \lambda + t$ = S.D. arc)

	Latitude (φ)						
d	0°	10°	20°	30°	40°	50°	60°
0°	0.00	0.17	0.34	0.50	0.64	0.76	0.86
± 9	0.00	0.17	0.34	0.50	0.65	0.77	0.87
± 18	0.00	0.18	0.36	0.52	0.67	0.80	0.91
± 27	0.00	0.19	0.38	0.56	0.72	0.86	0.97

The value of η has the same sign that of φ

For the instant $T_0 + t$, compute the following quantities in addition to x and y :

Let H = (H + λ) + $a\,t$ (converted into arc). The value of a has been given for planets under elements; it is 1.027 for stars. The observer's position on the fundamental plane is given by:

$$\xi = \rho \cos \varphi' \sin H \quad \text{and} \quad \eta = \rho \sin \varphi' \cos d - \rho \cos \varphi' \sin d \cos H$$

and the hourly variations ;

$$\xi' = 0.2618\, a\, \rho \cos \varphi' \cos H, \quad \eta' = 0.2618\, a\, \xi \sin d.$$

The value of the co-efficient 0.2618 a is 0.2625 for stars.

Let $u = x - \xi$, $v = y - \eta$, $u' = x' - \xi'$, $v' = y' - \eta'$ so that $n^2 = u'^2 + v'^2$.

Now sin $\psi = (uv' - vu')$ / nl, where l = 0.2725, for stars, and for planets, it will be found under elements.

The correction τ to the time of immersion and emersion is given by :

$$\tau = -(60/n^2)(uu' + vv') \mp (60\, l / n) \cos \psi$$

The negative sign in the second term is to be taken for immersion or the first contact and the positive sign for emersion or the last contact.

Instant of immersion or emersion = $T_0 + t + \tau$.

If greater accuracy is desired, a second set of calculations may be done in the following way using the new times now obtained as initial times. For the revised time of immersion or emersion T, compute H = (H + $\lambda + at) + a\tau$, $x, y, \xi, \eta, \xi', \eta'$; u, v, u', v' and D = $uu' + vv'$. The second correction t′ is given by : $t' = (30/D) \times [l^2 - (u^2 + v^2)]$ in mins. of time.

The final time of immersion or emersion = $T + t'$.

The angles of contact on the Moon's limb:

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$P = M + 180°$, where $\tan M = (u + u't') / (v + v't')$,

$V = P - C$, where $\tan C = (\xi + \xi' t') / (\eta + \eta' t')$,

where t′ is to be taken in hours.

PART V – Miscellaneous Tables

Phenomena

The stellar magnitudes of planets together with their elongations from the Sun have been given under 'phenomena' at suitable intervals of days. The computation in the next portion of the phenomena has been based on longitude and that in the Astronomical Diary mainly on right ascension, with the exception that the conjunctions, squares and oppositions of planets with the Sun included in the latter have been calculated on the basis of longitudes. In the case of conjunctions in right ascension, the differences in declination between the planets or the Moon and the planet have also been given. The dates of heliacal visibility of planets (Mercury to Saturn) have also been given and these are based on the method given on page 467.

Interpolation

Interpolation Coefficients have been given on pages 355 to 358 according to the formula of both Bessel and Everett, for each hundredth part of the time-interval.

Let the tabular value of a function given at equal intervals be represented by f and the first and second differences by Δ with relevant dashes and subscripts as shown below. It is required to determine the value of the function at some intermediate point.

Function	First difference	Second difference
f_{-1}		
	$\Delta'_{-½}$	
f_0		Δ''_0
	$\Delta'_{½}$	
f_1		Δ''_1
	$\Delta'_{1½}$	
f_2		

The epochs for which the values of the function are to be taken should be so chosen that the time for which the value of the function is required may fall within the interval f_0 and f_2 and let n be the time interval from f_0 up to the moment for which the value of the function is required. It is expressed as a fraction of the interval at which the given values of the function are tabulated. Let f_n be the value of the function for the desired time which is now required to be determined.

The two formulae for interpolation which are generally used for the purpose are as follows :

$f_n = f_0 + n\,\Delta'_{½} + B''(\Delta''_0 + \Delta''_1)$…………………Bessel
$f_n = f_0 + n\,\Delta'_{½} + E_0''\Delta''_0 + E_1''\Delta''_1$………………Everett

in which $f_0 + n\Delta'_{½}$ may be replaced by $(1-n)f_0 + nf_1$, if necessary, and where

$$B'' = n\,(n-1)/\,4,\ \ E_0'' = -\,n\,(n-1)\,(n-2)/\,6\ \text{ and }\ E_1'' = n\,(n+1)\,(n-1)/\,6$$

It will be noted that in Bessel's formula the value of $\Delta''_0 + \Delta''_1$ is the same as $\Delta'_{1½} - \Delta'_{-½}$. The value of the coefficients B'', E_0'' and E_1'', all of which are negative within the range f_0 to f_1 , will be obtained from the table on page 355 to 358 for the given value of n.

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Bessel's method of interpolation is more simple, but greater accuracy is yielded by Everett's formula on account of the fact that it includes the effect of third differences also.

The more complete formula of Bessel is as follows :

$$f_n = f_0 + n\Delta'_{½} + \{n(n-1)(\Delta''_0 + \Delta''_1)\}/4 + \{n(n-1)(n - ½)\Delta'''_{½}\}/6 + \cdots\cdots$$

The rate of variation of the function at a point, i.e., the instantaneous motion per unit of time interval may be obtained by the following formula :

Motion = $\Delta'_{½} + C\Delta_0'' + D\Delta_1''$, where $C = -(3n^2 - 6n + 2)/6$ and $D = (3n^2 - 1)/6$

When $n = 0$, the motion $f_0' = \{(\Delta'_{-½} + \Delta'_{½})/2\} - (\Delta_1'' - \Delta_0'')/6$,
when $n = ½$, $f'_{½} = \Delta'_{½} - \{(\Delta_1'' - \Delta_0'')/24\}$ and when $n = 1$, $f_1' = \{(\Delta'_{½} + \Delta'_{1½})/2\} - (\Delta_1'' - \Delta_0'')/6$

The stationary point (i.e., when $f' = 0$) occurs when $n = ½ - (\Delta'_{½}/\Delta''_1)$ or $½ - (\Delta'_{-½}/\Delta''_0)$.

Geocentric Co-ordinates and other Constants

The tables given on pages 363 and 364 are for computing the geocentric co-ordinates of a place for which the geodetic, i.e., geographic or common latitude φ is known. From the first table, the values of ρ sin φ′ and ρ cos φ′ can be directly obtained, while the second table gives the values of the geocentric latitude φ′ and the radius of the Earth ρ separately

The constants used for these tables and the others given below are the 1976 I.A.U. System of astronomical constants introduced in this publication with effect from the 1985 issue.

Equatorial radius (a) = 637 8140 m = 3963.20 miles.
Polar radius (b) = 635 6755 m = 3949.91 miles.
Flattening of the Earth (f) = (a-b)/a = 1/298.257 = 0.003 353 64.
Ellipticity or eccentricity (e) = 0.081 8192, e^2 = 0.006 694 39.

The following expressions are obtained from the above values of flattening and radius of the Earth.

$S = 0.994\,9743 - 0.001\,6708 \cos 2\varphi + 0.000\,0021 \cos 4\varphi$

$C = 1.001\,6799 - 0.001\,6820 \cos 2\varphi + 0.000\,0021 \cos 4\varphi$

$\rho = 0.998\,3271 + 0.001\,6764 \cos 2\varphi - 0.000\,0035 \cos 4\varphi$

$\varphi' = \varphi - 11'\,32''.726 \sin 2\varphi + 1''.163 \sin 4\varphi - 0''.003 \sin 6\varphi$

One degree of longitude (in km.) = 111.4133 cos φ - 0.0935 cos 3 φ

One degree of latitude (in km.) = 111.1334 – 0.5598 cos 2 φ + 0.0012 cos 4 φ

g (cm/sec²) = 978.031 + 5.1859 sin² φ - 0.0057 sin² 2 φ - 0.000 308H. where H is the elevation in meters above sea level.

Period of Earth satellite of negligible mass = 84.489 09 $d^{3/2}$ mins., where d is the mean distance of the satellite from the Earth's center measured in units of 6378140 m (Earth's equatorial radius).

Invariable plane of the solar system; $\Omega = 106°35'\,01'' + 3452''T$, $I = 1°\,34'\,59'' - 18''T$

Pole of galactic plane (1950); $\alpha = 12^h\,49^m.0$, $\delta = +27°\,24'$

Solar apex (1950).. $\alpha = 18^h\,06^m$, $\delta = +30°$

Solar motion = 20.0 km. or 12.4 miles per sec.

Speed of the Earth moving around the Sun = 29.79 km. or 18.51 miles per sec.

EXPLANATION

Heliacal Rising and Setting of Planets

The planets Mercury to Saturn (as well as the Moon) remain invisible to the naked eyes for some days at the time of conjunction with the Sun. This phenomenon of planet's invisibility due to its proximity to the Sun is known as combust or heliacal setting of the planets, and it plays an important part in Indian Calendar. The dates of heliacal setting and rising of the planets marking the period or invisibility have been calculated assuming that the phenomenon occurs when, at the given station, the Sun attains a Zenith distance of $90°+h$ at the time when the zenith distance of the planet is 90°. The values of h for different planets adopted for the purpose are as follows :

Mercury 10° (Direct) and 11° (Retrograde)
Venus 6°, Mars 14,° Jupiter 8°.5 , and Saturn 12°

The day of the first visibility of the lunar crescent after a new-moon day has also been determined in a somewhat similar way on the basis of the following values of the limiting altitude of the Moon above the horizon corresponding to its azimuth difference from the Sun, when the zenith distance of the Sun is 90°.

Azimuth difference	0°	5°	10°	15°	20°
Altitude	10°.4	10°.0	9°.3	8°.0	6°.2

When the altitude of the Moon at sunset exceeds the above limit, the Moon is likely to be visible in that evening and when the excess is more than a degree, the Moon is sure to be visible. The beginning dates of the months of the Islamic Calendar have been determined on the basis of the above calculations and indicated on the date following that of the first visibility of the Moon.

In the above calculations, the atmospheric refraction and the horizontal parallax of the Moon are neglected.

The computations of heliacal rising and setting of planets and determination of the dates of first visibility of the Moon have been done for the central station of India.

ASTRONOMICAL CONSTANTS*

Units : The units meter (m), kilogram (kg.) and second (s) are the units of length, mass and time in the International System of Unit (SI).

The astronomical unit of time is a time interval of one (*D*) of 86400 seconds. An interval of 36525 days is one Julian century.

The astronomical unit of mass is the mass of the Sun (*S*).

The astronomical unit of length is that length (*A*) for which the Gaussian gravitational constant (*k*) takes the value of 0.01720209895 when the units of measurement are the astronomical unit of length, mass and time. The dimensions of k^2 are those of the constant of gravitational (*G*), i.e. $L^3M^{-1}T^{-2}$. The term "unit distance" is also used for the length *A*.

Defining Constants :

1. Gaussian gravitational constant $k = 0.017\ 202\ 098\ 95$
2. Speed of light $c = 299\ 792\ 458\ ms^{-1}$

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Primary Constants :

3.	Light-time for unit distance	τ_A = 499.004 78384 s
4.	Equatorial radius for Earth	a_e = 637 8136.6 m
	[IUGG value	a_e = 637 8137 m]
5.	Dynamical form-factor for Earth	J_2 = 0.001 082 6359
6.	Geocentric gravitational constant	GE = 3.986 004 418 X 10^{14} m^3 s^{-2}
7.	Constant of Gravitation	G = 6.674 28 X 10^{-11} m^3 kg^{-1} s^{-2}
8.	Ratio of mass of Moon to that of Earth	μ = 0.012 300 0371
9.	General precession in longitude, per Julian century, at standard epoch J 2000.0	P = 5028".796195
10.	Obliquity of the ecliptic, at standard epoch J2000.0	ε = 23º 26' 21".406

Derived Constants

11.	Constant of nutation at standard epoch J2000.0	N = 9".2052 331
12.	Unit distance	$c\tau_A = A$ =1.495 978 707 x 10^{11}m
13.	Solar parallax	arc sin $(a_e/A) = \pi\odot$ = 8".794143
14.	Constant of aberration for standard Epoch J2000.0	k = 20".49551
15.	Flattening factor for the Earth	f = 0.003 352 82 = 1/298.25642
16.	Heliocentric gravitational constant	$A^3\, k^2/D^2 = GS$ = 1.327 124 42099 x 10^{20} m^3 s^{-2}
17.	Ratio of mass of Sun to that of the Earth	$(GS)/(GE) = S/E$ = 332 946.0487
18.	Ratio of mass of Sun to that of Earth + Moon	$(S/E)/(1+\mu)$ = 328 900.5596
19.	Mass of the Sun	(GS)/G = S = 1.9884 x 10^{30} kg
20.	System of planetary masses : (Ratios of mass of Sun to those of the planets etc.)	

Mercury	6023600	Jupiter	1047.348644
Venus	408523.719	Saturn	3497.9018
Earth + Moon	328900.5596	Uranus	22902.98
Mars	3098703.59	Neptune	19412.26
		Pluto	136566000

Other quantities for use in the preparation of ephemerides :

It is recommended that the values given in the following list should normally be used in the preparation of new ephemerides.

21. Masses of minor planets in unit of the solar mass :

(1) Ceres	4.72 x 10^{-10}
(2) Pallas	1.03 x 10^{-10}
(3) Vesta	1.35 x 10^{-10}

- -

*See page 446 also for some of the constants actually used in preparation of the ephemerides reported in the publication.

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22. Masses of satellites in unit of the planet's mass :

Jupiter	Io	4.704×10^{-5}
	Europa	2.528×10^{-5}
	Ganymede	7.805×10^{-5}
	Callisto	5.667×10^{-5}
Saturn	Titan	2.366×10^{-4}
Neptune	Triton	2.089×10^{-4}

23. Equatorial radii in km.

Mercury	2439.7	Jupiter	71492	Pluto	1195
Venus	6051.8	Saturn	60268		
Earth	6378.1366	Uranus	25559	Moon	1737.4
Mars	3396.19	Neptune	24764	Sun	696000

24. Gravity fields of the planets.

	J_2	J_3	J_4
Earth	$+ 1.08263 \times 10^{-3}$	$- 2.54 \times 10^{-6}$	$- 1.61 \times 10^{-6}$
Mars	$+ 1.964 \times 10^{-3}$	$+ 36 \times 10^{-6}$	
Jupiter	$+ 14.75 \times 10^{-3}$		$- 580 \times 10^{-6}$
Saturn	$+ 16.45 \times 10^{-3}$		$- 1000 \times 10^{-6}$
Uranus	$+ 12 \times 10^{-3}$		
Neptune	$+ 4 \times 10^{-3}$		

25. Gravity field of the Moon.

$\gamma = (B-A)/C = 0.000\,2278$		$C/MR^2 = 0''.392$
$\beta = (C-B)/B = 0.000\,6313$		$I = 5552''.7 = 1^{\circ}\ 32'\ 32.7''$
$C_{20} = -0.000\,2027$	$C_{30} = -0.000\,006$	$C_{32} = +0.000\,0048$
$C_{22} = +0.000\,0223$	$C_{31} = +0.000\,029$	$S_{32} = +0.000\,0017$
	$S_{31} = +0.000\,004$	$C_{33} = +0.000\,0018$
		$S_{33} = -0.000\,001$

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